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Section 1

Introduction

1.1 Company Overview and Contact Information

Our Mission
To contribute to the waterjet community through the engineering, manufacturing and sale of waterjet products that lower operating cost. To strive for the greatest reliability and quality in our products: to be the standard of comparison and to be a company recognized for honesty, integrity, and personal service.

The Company
AccuStream is a waterjet supply company with a history of providing economical solutions for a broad range of customers. Through the engineering, manufacturing and sale of quality parts and products, AccuStream has quickly earned a reputation for superior customer satisfaction. AccuStream's rapid shift to the forefront of the waterjet industry can be attributed to an unyielding focus on customer success through product reliability and unparalleled service from a well trained customer and technical support staff.

History
AccuStream's background in waterjet started in the mid 1980's with the development, application and sales of waterjet products for a major equipment manufacturer. In the late 1990's AccuStream was started with the goal of supplying quality spare parts and innovative products to help waterjet users lower their operating cost. Today, the company has become the leading source for industrial waterjet products.

Customer & Technical Service
At AccuStream, your purchase is only the beginning of our commitment to help you succeed. We think that what happens *after* the sale is just as important as what happens before. Customer Service Representatives are available to take your calls Monday through Friday 7:00 AM to 5:00 PM CST. If you need service after-hours, AccuStream is also on call 24 hours a day, 7 days a week to ensure your system is up and running round-the-clock. For more information, please call Customer Service at 763-717-7099 or toll-free 866-566-7099.

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1.2 System Overview

1.2.1 Introduction

This manual contains information necessary for the operation and routine maintenance of the AccuStream Model AS-6050 Intensifier Pump. The manual is arranged in a loose leaf format so pages may be added or removed. AccuStream, Inc., reserves the right to change any product specification or information herein without notice. Updates and revisions will be made available for insertion into the manual.

1.2.2 Pump Identification Form

AccuStream SERIAL NUMBER _____

For additional copies of this manual or other assistance, contact:

AccuStream, Inc.
4757 Mustang Circle
Mounds View, MN 55112
763.717.7099

1.3 Definitions

"**Low-pressure water**" or "**LP water**" means water that is supplied to the intensifier for pressurizing.

"**High pressure water**" or "**HP water**" means water that is directed to the tool after being pressurized by the intensifier assembly.

"**Coolant water**" means water that is circulated through the heat exchanger for cooling the hydraulic fluid.

"**Pump**" means the AS Series intensifier pump.

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Section 2

Safety

2.1 Safety Symbols

The following symbols are used throughout the manual to bring the readers' attention to known hazards and conditions which can be avoided. Although an attempt to point out most conditions was made, Accustream acknowledges that there are other unforeseen situations due to site variability, improper maintenance, etc. that could also potentially cause equipment damage, severe injury, or death. It is the end user's responsibility to identify these additional hazards and take necessary steps to minimize risks.

⚠ WARNING	Indicates the presence of a hazard, which can cause severe personal injury, death, or substantial property damage if the warning instruction is ignored
⚠ CAUTION	Highlights important instructions which must be followed to prevent personal injury and/or equipment damage.
⚠ IMPORTANT	Draws attention to items of important factual or procedural significance. Failure to follow the instructions may result in equipment damage.
	Hazardous voltage within can cause injury or death. Disconnect and lock out main power before opening the cabinet.
	High pressure waterjet can cause eye injury. Wear eye protection when operating or working near the machine.
	Wear ear protection when operating or working near the machine to reduce the risk of hearing loss.
	Airborne contaminants or suspended particles may exist when cutting certain materials. Wear respiratory protection when these conditions are present.

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2.2 Common Sense

- Most safety practices are common sense. Readers are expected to know how to use common hand tools, and the basic techniques of operating pressure-producing equipment. The manual provides information on hazards specifically related to the maintenance and operation of this equipment.
- The safety guidelines found in this manual are general, and cannot cover every possible situation. Only thorough knowledge of the equipment can provide optimum safety.
- The force of a waterjet can penetrate and cut through almost any material. Always avoid contact with the stream of water. Seek medical attention immediately if you have come in contact with a high pressure stream of water.
- People untrained in the safety and operation of a waterjet machine should not be allowed near the system.
- Always wear safety glasses when working on or near the pump.
- Clean and inspect equipment regularly and fix any problems immediately after discovered.

2.3 Operation and Maintenance Safety

The operation and maintenance of this system should only be performed by trained qualified personnel.

2.3.1 Operating Safety

⚠ WARNING **Failure to wear proper safety gear can result in personal injury or death. Safety shoes, hard hat, and other personal protective equipment are strongly recommended.**

Wear eye protection while the machine is operating.

Extended exposure to loud noise can cause permanent hearing damage. Wear hearing protection while the machine is operating.

Use respiratory equipment when necessary for personal safety.

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- Read and understand the Operations section of this manual before operating the equipment.
- Ensure that all personnel not involved in operating the machine are a safe distance from the equipment while it is running. Keep the work area clean and free of water or fluid spills.

2.3.2 Maintenance Safety

⚠ WARNING **Before starting any service or maintenance, turn off electrical power and relieve all water and hydraulic pressure. Proper lockout-tagout procedures must always be followed prior to performing any maintenance of the unit.**

- Read the instructions in all sections of this manual before performing any maintenance on the pump. Important information is contained throughout to minimize hazards and wear on the machine.
- Use the proper tools required for specific procedures. When special tools are called for, use them. They are specifically designed to make the job easier, and to prevent damage to the equipment. Remove all tools from the work area before starting the machine.
- Always test the pump after service or maintenance. Follow startup procedures outlined in the Operation section of this manual

2.3.3 Electrical System Safety

⚠ WARNING **Always make certain that electrical current is shut off and lockout-tag out procedures have been followed before starting any service or maintenance procedures.**

⚠ WARNING **Make sure the safety devices are operational. To panic stop the pump and bleed the high pressure, the EMERGENCY STOP buttons must be pushed in. The system pressure bleed down valves must be open.**

- Open the main power circuit breaker (plant-supplied power) before beginning the procedure. Attach a safety tag warning others not to turn the power on.
- When replacing wiring, use only the same size, type, and color as the original.
- After servicing, ensure all electrical breakers are reconnected and doors and covers are closed before restarting.
- To check: turn on power and activate the **EMERGENCY STOP** buttons by pushing them in to see if the power goes off.

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2.3.4 High Pressure Water System Safety

⚠ WARNING **Never work on any high pressure component, or loosen any high pressure fittings without first bleeding the system and assuring there is no high pressure water present. Follow all instructions and safety recommendations in this manual.**

- Do not come in contact with any high pressure water. HP water can penetrate any part of the human body and cause severe infection or death if not treated properly.
- Do not try to repair a leak in a HP water fitting when the system is pressurized. A leak at a sealing surface can cause a hazardous spray of water out the nearest weep hole. Shut off the motor and double check the HP water pressure is relieved down the drain before servicing any high pressure plumbing.
- Plumbing supports and guides must be used for all HP tubing exiting the pump. Failure to do so can introduce excessive bending stress and fatigue through vibration causing premature failure of the plumbing.
- Always use two wrenches when tightening or loosening HP connections, one for the gland nut and one for the fitting. Excessive bending stress can be introduced to the plumbing causing premature failure.
- Always use high pressure piping rated for the pressures you will be operating at. This pump is capable of outputting 60,000 psi of water.

2.3.5 Hydraulic System Safety

⚠ WARNING **Pressurized fluid streams can penetrate skin, causing severe personal injury. If any fluid is ejected against the skin, immediately seek medical attention.**

- Make sure all connections are properly tightened after performing service or maintenance.
- Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Never check for hydraulic leaks with your hand. Use a piece of cardboard or other material.
- Do not attempt to tighten or loosen any mechanical connection unless the machine is powered off and all system pressure has been relieved.

2.3.6 Motor/Pump Assembly Safety

⚠ WARNING **Beware of moving equipment. Keep clothing and hands away from equipment that is operating. Always verify covers and shields are in place before starting equipment.**

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2.3.7 Emergency Medical Treatment

WARNING **Always seek medical attention immediately in the event of contact with a high pressure stream of water. Failure to do so can result in severe infection.**

Waterjet equipment can cause severe injury and infection. Any injury involving high pressure water or hydraulic oil, no matter how small, should be reported immediately and treated. Always seek medical attention and inform the medical personnel the victim has been working with high pressure water up to 60,000 psi and nozzle velocities of up to 2000 feet per second.

Waterjet injuries have been known to cause infections with micro-aerophilic organisms such as gram-negative pathogens like found in sewage. Bacterial swabs and blood cultures can aid in determining if any infection is present. The injury should be treated as an acute surgical emergency and be evaluated by a qualified surgeon. Circulation may be compromised therefore DO NOT apply heat. Keep injured person awake, elevate injured part, and get antibiotics.

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Section 3

Installation

3.1 Installation Overview

3.1.1 Buyer Obligations

The buyer of an AS-Series waterjet pump is responsible to cooperate with AccuStream and Accustream OEM personnel to facilitate installation of the machine.

- The pump should be uncrated and placed as close as possible to the position it will be used in.
- All Utilities must be provided prior to installation as outlined in the Specifications section of this manual.
- High pressure tubing should be installed by the buyer unless other arrangements have been made in the sales agreement.
- Water treatment equipment should be in place prior to the installation of the pump. Water must meet the minimum requirements as outlined in the Specifications section of this manual.
- All connections to the pump are the responsibility of the buyer. It is the buyer's responsibility to research and comply with all local codes including waste water disposal.
- AccuStream supplies the pump without any hydraulic oil in the tank. It is the buyer's responsibility to fill the tank with the appropriate oil per instruction in the hydraulic section of this manual.

3.1.2 Seller Obligations

If AccuStream, Inc. is the installing party, some or all of the following tasks will be the responsibility of the AccuStream technician at installation as defined in the sales agreement.

- Make sure the buyer has been informed of all buyer obligations and make sure the site has been properly prepared prior to installation.
- Make sure all utility connections have been properly provided as outlined in the Specifications section of this manual.
- Follow all first time startup and setup instructions as provided in the Operations section of this manual.
- Train maintenance personnel on proper service and repair procedures.
- Follow standard system acceptance tests.

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3.2 Utility Requirements

3.2.1 Site Preparation

⚠ WARNING **Certain locations may be hazardous if the atmosphere contains gas, vapors, or dust in explosive quantities. Refer to the National Electric Code (NEC), OSHA requirements, and local codes for detailed information about environmental criteria.**

The facility must have adequate air, water, sewer drain, and electrical service per specifications prior to installation of the equipment.

Floor material should be concrete capable of supporting the weight of the machine, and thick enough to provide resistance to vibration.

3.2.2 Water Requirements

Cutting Water: The water supplied to the intensifier is a crucial factor in precision waterjet cutting because of its direct affect on the service life of equipment components. The pump's built-in filtration is sufficient for removal of suspended solids. Total Dissolved Solids (TDS) in the inlet water will have an adverse effect on check valves, seals, orifices, and other consumables. Most systems soften the water before it enters the pump.

Before installing the system have a water quality analyses performed by a local company that can provide water conditioning equipment. See the Water Quality Section under Specifications for specific conditioning requirements.

Cooling Water: The heat exchanger uses regular tap water for cooling the hydraulic fluid. Hydraulic fluid temperature must be maintained below 130° F. A consistent water flow of 3 gpm is required, at an inlet temperature not exceeding 70° F.

In most cases public-utility water is acceptable. In situations where the water contains heavy mineral deposits, the cooling fins in the heat exchanger may become clogged with buildup. In these circumstances pre-filtration and/or softening may be necessary. Depending on plant setup, ambient temperature can also be a factor in cooling. Where the equipment is confined to a small high-temperature space additional cooling may be required.

3.2.3 Sewer Requirements

The pump has two outlet lines. The Waste Water Out line carries any leakage water from the drip pans, and rejected cut water from the bleed down valve. The cooling water out line carries the water exiting the heat exchanger. Do not couple the lines together. Both outlets require independent lines to the sewer

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drain to prevent cooling out water from backing up into the system. The waste water outlet is gravity fed from the water pans and therefore must have sufficient drop to prevent backup into the system. It is the end user's responsibility to investigate and comply with all local codes.

3.2.4 Electrical Requirements

⚠ CAUTION **When connecting power to the pump it is the buyers responsibility to investigate and comply with all local codes. The power requirements are listed on the serial plate on the back of the pump as well as on the inside of the electrical enclosure door.**

EACH OF THE THREE PHASES OF INPUT POWER ARE CONNECTED TO THESE TERMINALS

3.2.5 Location Requirements

The pump must be placed in a location which allows access to all sides for service. The pump should have a 36 inch minimum clearance free of all obstacles to allow room for service. See the Pump Requirements Section under Specifications

The pump should not be placed in any environment where the temperature is below freezing. If freezing temperatures are expected before operating again, drain all water lines and filter housings after work is completed for the day.

⚠ WARNING **If a water line, fitting, or valve may be frozen, DO NOT operate the machine. The system must be thawed until water flows freely through the entire water circuit.**

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3.2.6 Recommended Tools

Most maintenance of the pump can be accomplished using standard tools. Refer to the recommended tools list in the Drawings and Parts Lists Section.

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Section 4

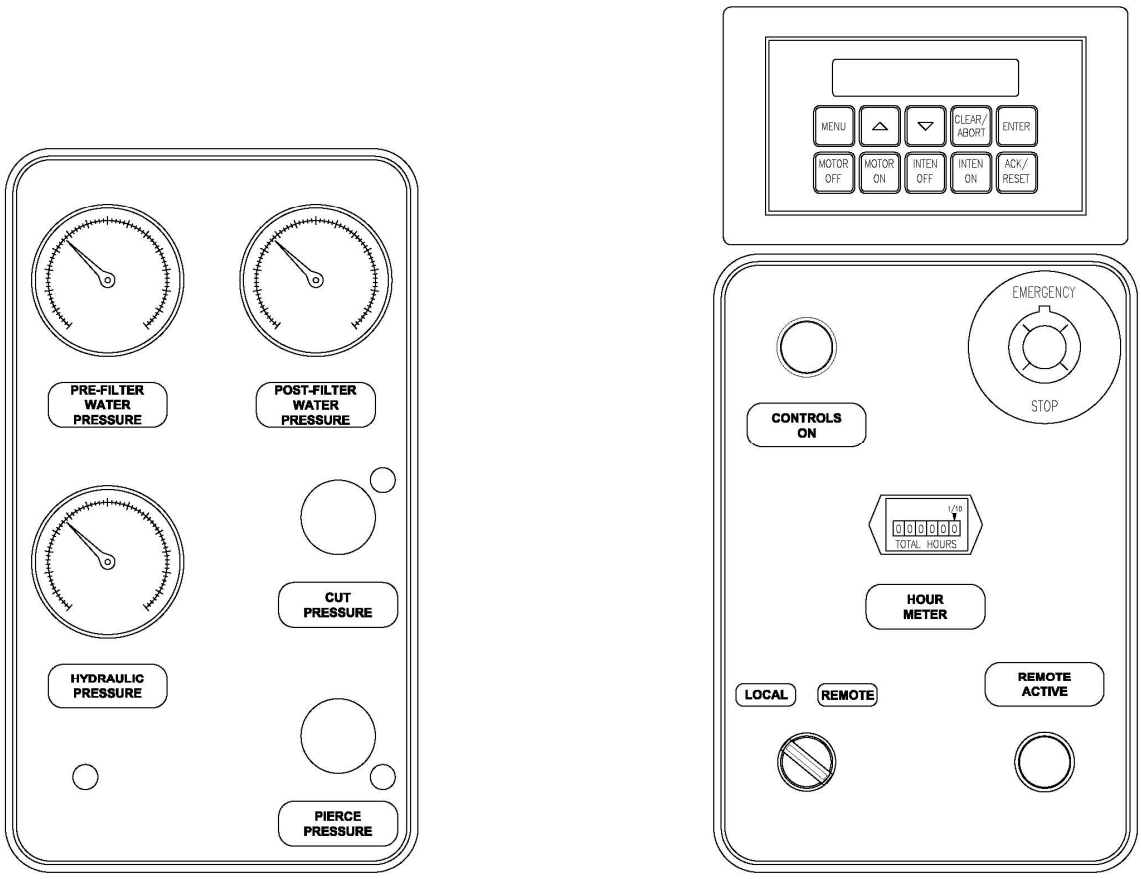
Operation

4.1 Operation Overview

The AS-Series pumps are controlled from the front control panel. The main disconnect on the electrical enclosure must be turned on in order for the pump to function. This section outlines the operation of the front control panel, startup procedures, normal operation, and menu modes.

4.2 Front Control Panel

The AS-Series Front Control Panel consists of a LCD display, 10 function buttons, pierce pressure and cut pressure adjustment knobs, and water and hydraulic gauges. The control panel communicates with a PLC which controls all pump operations as well as monitors the system for fault conditions. The controls can only be turned on if the main disconnect is turned on. Review all button functions, read this section completely, and follow all instructions before attempting to start the pump. The following is an image of the Front Control Panel and a summary of its components and functions.



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- **MENU** enters the main menu mode of the controls. See the Menu Modes section of this manual.
- The **UP ARROW** toggles between Pressure Set Point 1 (Cut) and Pressure Set Point 2 (Pierce). This button is also used for scrolling up in any menu mode.
- The **DOWN ARROW** toggles between Pressure Set Point 1 (Cut) and Pressure Set Point 2 (Pierce). This button is also used for scrolling down in any menu mode.
- **CLEAR/ABORT** exits active menu mode.
- **ENTER** toggles in and out of EDIT mode while in different menus. See the Menu Modes section of this manual.
- **MOTOR ON** turns on the Boost Motor, Main Motor, Cutting Water Solenoid, and Cooling Water Solenoid. This button is only active while the pump is in local mode.
- **MOTOR OFF** turns off the Boost Motor, Main Motor, Cutting Water Solenoid, and Cooling Water Solenoid. This button works while the pump is in local and remote modes.
- **INTEN ON** turns on the Intensifier in Pierce Pressure for 5 seconds before ramping up to Cut Pressure. This button is only active while the pump is in local mode.
- **INTEN OFF** turns off the Intensifier and reduces hydraulic pressure which opens the bleed down valve and relieves the high pressure water. This button works in local and remote modes.
- **ACK/RESET** resets pump faults.
- **EMERGENCY STOP** shuts off Controls, Motors, Intensifier, and bleeds down the high pressure water
- **CONTROLS ON** enables the pump controls.
- **LOCAL/REMOTE KEYSWITCH** switches from Local Pump Control to Remote Pump Control. See the section on Remote Pump Control in this manual.
- **REMOTE ACTIVE** light is lit when pump is in Remote Pump Control mode.
- **CUT PRESSURE** knob adjusts Pressure Set Point 1 (Cut). See Adjusting the Cut and Pierce Pressure for more information.
- **PIERCE PRESSURE** knob adjusts Pressure Set Point 2 (Pierce). See Adjusting the Cut and Pierce Pressure for more information.
- **HYDRAULIC PRESSURE** gage displays the hydraulic pressure of the pump.
- **PRE-FILTER WATER PRESSURE** gage displays the water pressure before the filter bank. See the Low Pressure Water section of this manual for more information.
- **POST-FILTER WATER PRESSURE** gage displays the water pressure after the filter bank. See the Low Pressure Water section of this manual for more information.

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4.3 Pump Startup

4.3.1 First Time Startup

The first time you start up your pump it is important that a Pre-Start Inspection, Motor Direction Check and an Initial Startup Procedure be performed to prevent serious damage to the pump components. Make sure that all installation requirements have been met prior to performing any of the following checks. Follow all safety procedures as outlined in the safety section of this manual.

Pre-Startup Inspection

a) Verify all safety circuits are connected and operational.
b) Make sure the hydraulic reservoir is full by checking the sight gauge. Add oil as necessary to bring the oil to an acceptable level. Use only Mineral Oil ISO VG 32. Refer to the Hydraulic Oil Requirements section in this manual for instructions on adding oil.
c) Verify all utilities are connected to the pump and turned on at the plant.
d) Check for loose hoses and fittings and make sure there are no leaks present.

Motor Direction Check

IMPORTANT **The motor direction check should be performed anytime any electrical maintenance has been performed on the electrical panel, motor wiring, or line wiring to the pump. Improper motor rotation can cause irreversible damage to the hydraulic pump and components.**

CAUTION **This procedure involves exposing a rotating shaft. Never place any object or any part of your body near the shaft while exposed. Only visual inspection should be used to prevent bodily injury. Be prepared to press the EMERGENCY STOP pushbutton if necessary.**

a) Remove the front cover from the pump and locate the motor rotation direction arrow.
b) Remove the safety cover on the pump mount to visually inspect the coupling rotation.
c) To jog the motor, pull the EMERGENCY STOP button on the control panel, and then press the CONTROLS ON button.
d) With one hand on the MOTOR ON button and the other on the MOTOR OFF button, quickly jog the motor. Verify visually that the shaft is rotating the same way the motor rotation arrow indicates.
e) If the motor rotates in the wrong direction, swap a pair of wires at the starter panel's main disconnect, not at the motor or starter contactors, and then recheck the rotation.
f) After verifying motor rotation, replace the safety cover on the pump mount and the side covers.

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First Time Startup

During installation it is possible that small pieces of debris are present in the high pressure lines. A line filter is provided at the back of the pump; however pieces of debris downstream of this may damage an orifice in the cutting head. The orifice used for startup should be replaced after the first 5-10 hours of operation.

IMPORTANT **The following First Time Startup procedure should be followed after any service has been performed on the Intensifier, High Pressure Water, or Low Pressure Water assemblies.**

a) Start motor by pressing the motor on button below the LCD display. Make sure that the boost pressure is between 50 and 115 psi.
b) If the pump was shipped during winter the fittings were loosened and need to be inspected for leaks. Verify that all leaks are corrected before proceeding to the next step.
c) Make sure the pump is set to Pressure Set Point 2 (Pierce). Press the UP or DOWN arrow keys to toggle between set point 1 and set point 2.
d) Turn on the on off valve at the cutting head.
e) Press INTEN ON and the hydraulic pressure will start to rise and the intensifier will begin to cycle.
f) Inspect all high pressure lines for leaks. If any leaks are present refer to the HP Water section of this manual for instructions on correcting leaks.
g) After running in Set Point 2 for a minimum of 10 minutes change to Pressure Set Point 1 (Cut) by pressing the UP or DOWN arrow keys.
h) Inspect all High Pressure lines and fittings for leaks. Turn the cutting head on and off several times to clear any debris in the lines. Let the pump run for several minutes before shutting down again.
i) Verify that the hydraulic oil temperature stabilizes at 110F or below. If the temperature is higher see the water modulating valve adjustment in the LP water section

4.3.2 Normal Startup Procedure

a) Verify all safety circuits are connected and operational.
b) Make sure the hydraulic reservoir is full by checking the sight gauge. Add oil as necessary to bring the oil to an acceptable level. Refer to the Hydraulic Oil Requirements section in this manual for instructions on adding oil.
c) Verify all utilities are connected to the pump and turned on at the plant.
d) Check for loose hoses and fittings and make sure there are no leaks present.
e) Press MOTOR ON and verify that the boost pump pressure is 50-115 psi.
f) Press INTEN ON and the pump will start generating pressure at the Set Point 2 for 5 seconds before switching to Set Point 1.

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4.4 Pump Operation

After startup inspections have been completed and the machine is running, no further direct action from the operator is required. Periodically check warning indicators and gauges and inspect everything visually to ensure developing problems are detected before the equipment is damaged.

4.4.1 Normal Operation

During normal operation the pump will continue to stroke to meet the cutting water demand. When the cutting nozzle is closed the pump will operate on standby; hydraulic pressure remains at the set pressure and the intensifier is idle. It is normal to see an increase in the pressure of the output water. This is called the Dead Head Rise. When the cutting nozzle is turned on the intensifier will begin to stroke again at a rate to meet the demand.

4.4.2 Adjusting the Cut and Pierce Pressure

The cut pressure and pierce pressure can each be adjusted using the knobs on the front of the pump. To adjust Cut pressure the LCD display must read Pressure Set Point 1 (Cut). If the display reads set point two press either the up or down arrow key to toggle back to set point 1. To adjust the pierce pressure the LCD display must read Pressure Set Point 2 (Pierce).

Note: When in Pierce Pressure mode if the set point of the Cut pressure is lower than the set point of the Pierce pressure the pump will operate at the lower of the two.

4.4.3 Remote Pump Operation

Accustream AS-Series pumps come standard with built in functionality for remote operation. The pump includes two options for external control that integrators can use: External Pressure Control and Remote Pump Control. Information on wiring connections is provided in the Electrical System section of the manual.

External Pressure Control (EPC) allows the user to switch from high to low pressure by closing a switch. All other pump functionality remains at the pump's front control panel while in EPC mode as long as the key switch remains in the Local position.

Remote Pump Control (RPC) deactivates the Controls On, Motor On, and Intensifier on at the front panel of the pump. These inputs are then solely controlled from a remote source. Motor Off, Intensifier Off, and E-Stop are active at both the front control panel and the remote source. Remote Pump Control is activated by turning the key switch to the Remote setting.

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4.4.4 Menu Modes

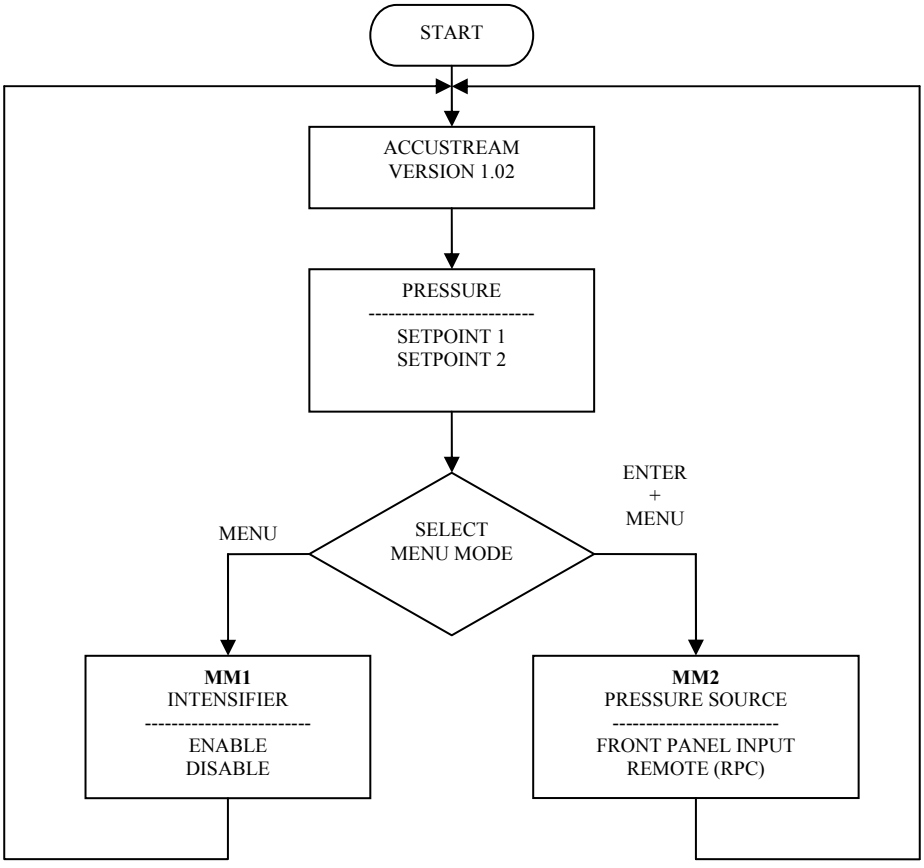
The AS-Series pumps have two different menu modes accessible from the main display. The first menu mode (MM1) is used to disable the intensifier for troubleshooting or setup purposes. The second menu mode (MM2) is used to switch between local pressure control and external pressure control.

The following is the MM1 procedure to ENABLE or DISABLE the Intensifier for pump setup.

a) Press MENU and screen will read INTENSIFIER ENABLE and will have a 0 in the upper right hand corner. The 0 signifies that you cannot edit the setting.
b) Enter EDIT mode by pressing ENTER. You will see the 0 change to a 1.
c) Press the DOWN arrow key to toggle between ENABLE and DISABLE.
d) Press the ENTER key again to exit EDIT mode when you are on the desired setting.

Procedure to set the pump to External Pressure Control without Remote Pump Control active

a) Press and hold ENTER + MENU to enter MM2. You should see a screen which reads Pressure Source Front Panel input. Note the 0 in the upper right hand corner.
b) Press ENTER to edit the value. Note the 0 changed to a 1.
c) Press the UP or DOWN arrow keys to toggle between Front Panel Input and External (EPC).
d) When you are on the desired setting press the enter key again to exit the edit mode.



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4.5 Shutdown

4.5.1 Normal Shutdown Procedure

WARNING **Never leave water jet cutting equipment turned on and unattended.**

IMPORTANT **After the equipment is shut down always make sure the high pressure water is relieved by turning on the cutting head.**

a) Turn the cutting equipment off.
b) Press the Intensify Off and Motor Off pushbuttons.
c) Pull the main disconnect handle to the off position (Down)
d) Turn off the plant cutting and cooling water.
e) Verify the high pressure gage reads zero.

4.5.2 Emergency Shutdown Procedure

The pump has an EMERGENCY STOP (E-STOP) palm button located on the Front Control Panel. In the event of an emergency press the E-STOP palm button. This will immediately remove electrical power from the motor and controls. The bleed down valve opens and the high pressure water is relieved down the drain.

If the pump is installed with a motion system and is configured to run remotely it is common for the emergency circuits from the robot or cutting table in series with the local E-STOP circuit. In the event that the pump has been shut down from a remote E-STOP circuit it is necessary for the operator to first remove or reset the condition that caused the stop. The pump can then be re-started following the normal startup procedure listed earlier in this section.

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Section 5

Electrical System

5.1 Overview

The AS-6050 has one 50hp main motor, and a 1/2hp boost pump motor. The electrical enclosure contains the main disconnect, the motor starters, and the control components. All internal control power is derived from the 3 phase input power. The electrical section of this manual discusses the following:

- Electrical Control Panel
- Motors and Motor Starter Circuits
- Fault Detection

5.2 Electrical Control Panel

5.2.1 PLC and LCD Display

The operator controls the intensifier pump through the LCD Display (OI-1) on the front of the electrical enclosure which communicates with the programmable logic controller (PLC-1) located inside the electrical enclosure. The PLC monitors all fault conditions, and controls the intensification process. In the event that the communication is interrupted between the operator interface and the PLC the pump will be shut down and not able to restart until the interruption is corrected.

The PLC program is loaded and tested at AccuStream prior to pump shipment. The program is stored on Flash ROM so no battery backup is needed in the PLC. No service is necessary on the PLC. All inputs and outputs are run to terminal blocks which should be used for wiring the remote options.

5.2.2 Disconnects and Fuses

The electrical cabinet has three different power levels contained inside; 460VAC, 115VAC, and 24VDC. The motors are powered by the 460VAC power. The PLC, LCD Display and all components wired to the input side of the PLC are 24VDC. The motor starters, solenoids and all other components wired to the outputs of the PLC are 115VAC.

Main power enters the cabinet and lands at the top of the main disconnect (MAIN DISC-1). The 460VAC power then runs through each motor contactor circuit to the main motor and the boost motor. Two legs of the 460VAC power run to a transformer (XFORMER-1) which produces the 115VAC power. The 24VDC power supply (DC-1) is powered by the 115VAC power. The 24VDC power supply is wired to the PLC and Display Panel. Refer to the electrical schematic to see locations of the fuses. The following is a fuse chart for reference.

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Fuse Name	Type	AS PN	Function
FU-1	FNQ-1.5	11701	Fuse on input leg of power to XFORMER-1
FU-2	FNQ-1.5	11701	Fuse on input leg of power to XFORMER-1
FU-3	FNQ-4	11702	Fuse on 115VAC output from XFORMER-1
FU-4	CC-2	12090	Fuse on 24VDC output from DC-1
FU-5	MDA-1.5	11703	Fuse for Outputs Y1-Y4 on PLC
FU-6	MDA-1.5	11703	Fuse for Outputs Y5-Y8 on PLC
FU-7	MDA-1.5	11703	Fuse for Outputs Y9-Y12 on PLC
FU-8	MDA-1.5	11703	Fuse for Outputs Y13-Y16 on PLC

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5.2.3 Remote Operation Wiring

Accustream AS-Series pumps come standard with built in functionality for remote operation. The pump includes two options for external control that integrators can use: External Pressure Control and Remote Pump Control.

External Pressure Control (EPC) allows the user to switch from high to low pressure by closing a switch. All other pump functionality remains at the pump's front control panel while in EPC mode as long as the key switch remains in the Local position.

Remote Pump Control (RPC) deactivates the Controls On, Motor On, and Intensifier On at the front panel of the pump. These inputs are then solely controlled from a remote source. Motor Off, Intensifier Off, and E-Stop are active at both the front control panel and the remote source. Remote Pump Control is activated by turning the key switch to the Remote setting. The wire connections and a terminal block drawing are included for reference.

Required RPC Connections

Description	*Wire No*	*Voltage*	*Type Contact*
Remote Controls On	7010,6015A	24VDC	Momentary, Normally Open
Remote E-Stop	6015A, 6015B	24VDC	Normally Closed
Remote Pressure Control*	24VDC, 7018	24VDC	Maintaining, Normally Open
Remote Motor On Input	24VDC, 7030	24VDC	Maintaining, Normally Open
Remote Intensifier On Input	24VDC, 7031	24VDC	Maintaining, Normally Open

* Can be used with the key switch in the Local position as long as EPC mode is active. EPC mode is always active when the key switch is in the Remote position.

Optional RPC Connections

Description	*Wire No*	*Voltage*	*Type Contact*
Remote Controls On Indicator	6015D, 24COM	24VDC	
Remote Mode Active Indicator	8010, 115COM	115VAC	
Remote Pump Fault Indicator	7055, 115COM	115VAC	
Remote Pump Run Indicator	8016, 115COM	115VAC	

Sequence of Operation

To operate in remote mode the key switch on the pump must be set to the remote setting.

a) Momentarily activate the Remote Controls On.
b) Activate the Remote Motor On and Wait 0.2 Seconds.
c) Activate the Remote Intensifier On input and pause for 7.5 seconds to ramp up to high pressure (or activate the Remote Pressure Control input for low pressure setting).

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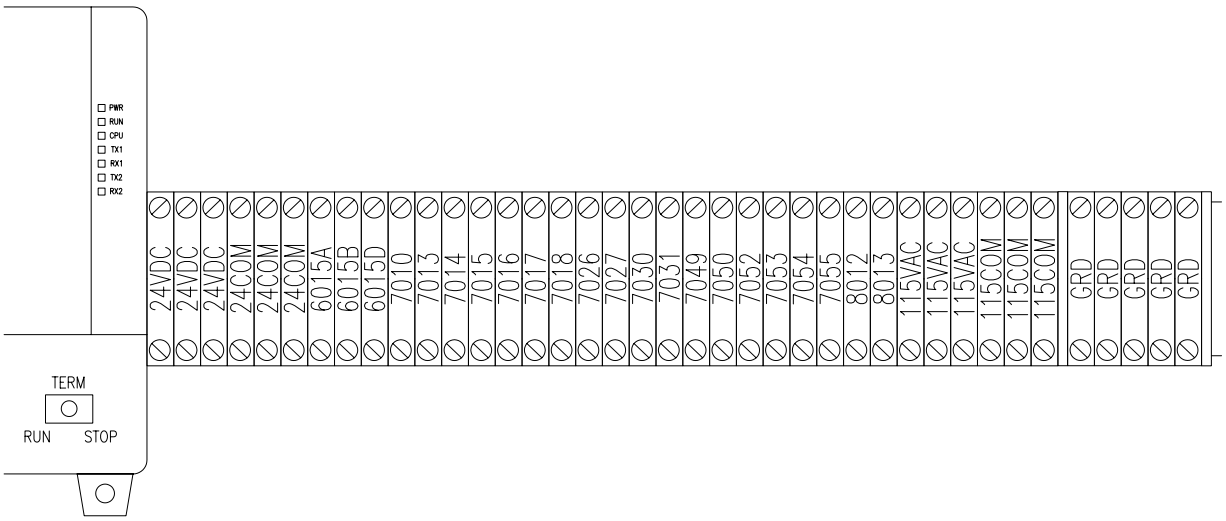

Terminal Blocks for Remote Wiring

5.2.4 Electrical Components Torque Chart

When servicing the electrical enclosure and components within it is good practice to torque the components to the proper values to reduce the possibility of a component shaking loose from vibration. The following is a list of recommended torque values for the electrical components.

ITM	DESCRIPTION	AS P/N	IN-LB	N*m
1	TERMINAL BLOCK	11707	3.5-5.3	0.4-0.6
2	GROUND BLOCK	11709	4.4-6.2	0.5-0.7
3	65 AMP CONTACTOR	11757	45	5
4	65 AMP CONTACTOR CONTROL	11757	15	1.7
5	65 AMP THERMAL OVERLOAD LUGS	11760	45	5
6	40 AMP CONTACTOR LUGS	11758	45	5
7	40 AMP CONTACTOR CONTROL	11758	15	1.7
8	BOOST PUMP CONTACTOR LUGS	11712	15	1.7
9	BOOST PUMP CONTROL COIL	11712	10	1.2
10	MAIN CIRCUIT BREAKER	11698	250	29
11	PLC	11683	4.5-6.2	0.5-0.7
12	24VDC FUSEHOLDER	11705	4.4-6.2	0.5-0.7
13	120V FUSEHOLDER	11706	4.4-6.2	0.5-0.7
14	24VDC POWER SUPPLY	11689	4.5-6.2	0.5-0.7

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5.3 Motors and Motor Starter Circuits

5.3.1 Main and Boost Motors

The main motor is the backbone of the AS-Series pump. The motor transfers rotation through a jaw type coupling to the main pump which is through-shafted to the gear pump. The boost motor is a ½ horsepower motor which drives the boost pump to provide adequate water pressure to the intensifier.

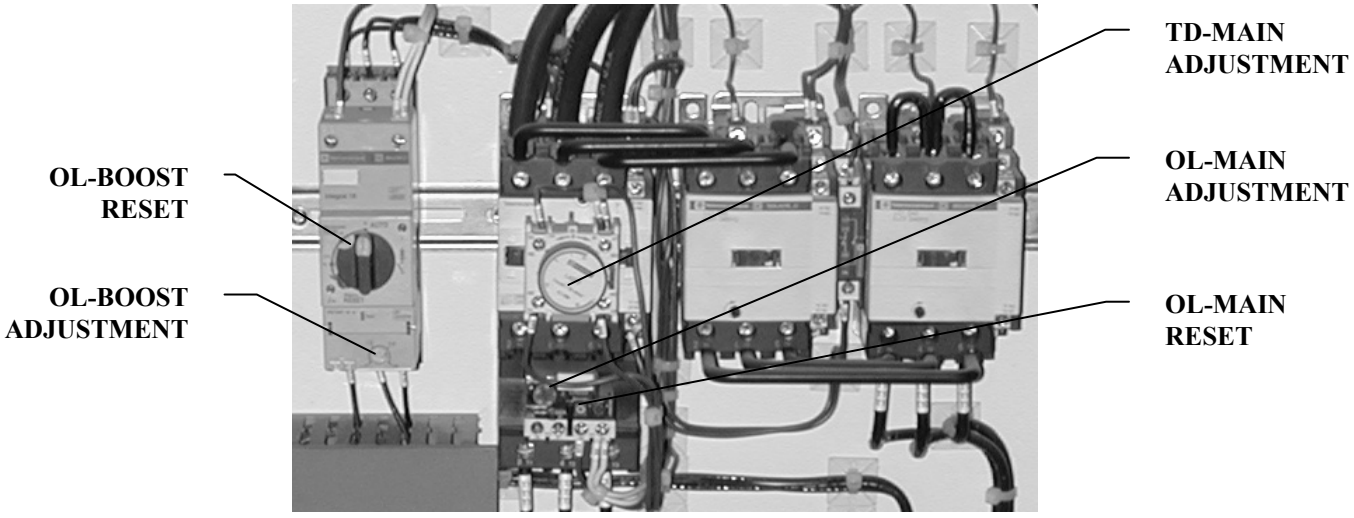
5.3.2 Motor Starters

The main motor starter is a Wye-Delta type. This is considered a reduced voltage class of starter. When the MOTOR ON pushbutton is pressed the motor starts in a WYE configuration which reduces the initial current draw of the motor for startup. The timer TD-MAIN setting determines how long the pump will run in the WYE configuration before switching to DELTA which is the run condition. The timer TD-MAIN should be set to about 2 seconds. While the motor is in the Delta configuration it can run at full current and torque. When the MOTOR OFF pushbutton is pressed the contactors open and the motor turns off. The intensifier, cooling water solenoid, cutting water solenoid, and boost pump motor also turn off when the MOTOR OFF button is pushed. Any time the motor is turned off the hydraulic pressure drops to zero which allows any high pressure water in the system to open the bleed down valve and exit through the drain. The main circuit breaker MAIN DISC-1 provides short circuit protection and disconnect.

5.3.3 Thermal Overload Protection

The main motor and boost motor starters both have thermal overload protection. The main motor thermal overload OL-MAIN should be set to 38 amps for the AS-6050. To set this you need a Philips screw driver to turn the adjustment dial. The boost pump thermal overload should be set to 1.6 Amps.

To reset the OL-MAIN in the event that it has tripped, press the reset button. To reset the OL-BOOST turn the dial to RESET and then back to AUTO.



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5.3.4 Motor Service

Boost Motor Replacement and Direction Check

In rare cases the boost motor may need to be replaced. If the boost motor is in need of replacement always make sure to wire the new motor following the proper wiring diagram for 460VAC 60Hz. After replacing the motor it is necessary to perform a rotational direction check. Take the following steps to ensure that the motor and boost pump are not damaged from improper rotation.

g) Remove the front and rear cover from the pump.
h) Make sure that you can see the boost motor coupling through the pump mount. It may be necessary to have two people for this procedure.
i) To jog the motor, pull the EMERGENCY STOP button on the control panel, and then press the CONTROLS ON button.
j) With one hand on the MOTOR ON button and the other on the MOTOR OFF button, quickly jog the motor. Verify visually that the shaft is rotating the same way the motor rotation arrow indicates.
k) If the motor rotates in the wrong direction, swap a pair of wires at the bottom of the boost motor starter MS-BOOST. Perform the previous steps again to make sure the rotation has reversed.
l) After verifying motor rotation, replace any covers that were removed.

Main Motor Lubrication

The main motor is supplied with sufficient grease to last indefinitely under normal service conditions. Under severe or extreme operating conditions it may be necessary to add grease to each of the motor bearings. Use a good quality, moisture resistant, polyurea-based grease such as Chevron SRI #2. DO NOT use lithium based grease. Mixing the two types of grease may result in loss of lubrication and shorter motor bearing life.

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5.4 System Fault Detection

The AS-Series pumps have a series of fault conditions that are constantly monitored by the PLC. If any fault condition is sensed by the control a message is displayed on the LCD screen. Each fault condition is classified into one of three categories of severity; **Warning, Shutdown I, and Shutdown II.** The following is a list of conditions broken down by category. For information on troubleshooting these conditions please refer to the maintenance and troubleshooting portion of this manual.

- **Warning** conditions are characterized by the yellow light on the light stack blinking and a message is displayed on the LCD screen.

- **Shutdown I** conditions are characterized by the red stack light blinking and the intensifier shutdown but the motor is still running. A message is also displayed on the LCD screen.

- **Shutdown II** conditions are characterized by the red stack light blinking and the motor and intensifier shutdown. A message is also displayed on the screen.

5.4.1 Warnings Messages

Warning messages are the least severe of the categories. The purpose of the warning is to alert the operator of conditions that if ignored can result in a shutdown condition. The following conditions can cause a Warning to occur.

- HYDRAULIC OIL TEMP > 130F (55C)
- TOO MANY MOTOR STARTS PER HOUR

Hydraulic Oil Temp >130F (65C)

The probe in the hydraulic oil tank has two temperature switches. One switch opens at 130F (55C) and the other at 150F (65C). If the lower temperature is exceeded the yellow light will begin to flash warning the operator of a potential cooling water problem. The most likely cause of this condition is the cooling water is not turned on or the inlet cooling water temperature is too high. The water modulating valve may also be out of adjustment. Review the Low Pressure Water section of this manual to troubleshoot the cooling water. After correcting the problem press the ACK/RESET button on the control panel to turn off the Warning light.

Too Many Motor Starts per Hour

The motor can be damaged if it is started too frequently. The threshold for this warning is set to six times in 15 minutes. If this number is exceeded the yellow light will blink and the message will be displayed on the LCD screen. Reset the alarm by pressing the ACK/RESET button on the control panel. Wait 15 minutes before starting the motor to allow time for the windings to cool.

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5.4.2 Shutdown I Messages

Shutdown I fault conditions are severe enough to cause the Intensifier to shutdown, but keep the motor running. The red light will be flashing and one of the following messages will be displayed on the LCD screen.

- INLET WATER PRESSURE BELOW 40PSI (2.8BAR)
- HYDRAULIC OIL TEMP > 150F (65C)
- INTENSIFIER OVERCYCLE

Inlet Water Pressure Below 40PSI (2.8BAR)

There is a pressure switch that senses the water pressure after the boost pump. If the water pressure falls below the set point, the monitoring circuit will open and this fault will occur after ten seconds. The most likely cause is failure of the water supply to the pump. Make sure that the plant supply water is turned on. Check the cutting water in solenoid for correct operation. If the cutting water solenoid does not open when the motor is turned on, replace solenoid valve. Clogged water filters can also cause low inlet water pressure. Read the Low Pressure Water section of the manual to identify other possible causes. Once the problem is corrected resume normal operation of the pump.

Hydraulic Oil Temp > 150F (65C)

The probe in the hydraulic oil tank has two temperature switches. One switch opens at 130F (55C) and the other at 150F (65C). If the higher temperature is exceeded the red light will begin to flash and the intensifier will shut down warning the operator of a potential cooling water problem. The most likely cause of this condition is the cooling water is not turned on or the inlet cooling water temperature is too high. The water modulating valve may also be out of adjustment. Review the Low Pressure Water section of this manual to troubleshoot the cooling water. After correcting the problem press the ACK/RESET button on the control panel to turn off the Warning light.

Intensifier Over Cycle

The intensifier over cycle fault is caused when the hydraulic piston travels one or both ways too quickly. If the intensifier strokes seven times in one direction and each stroke is less than the set threshold, the over cycle fault will be triggered. If the piston is traveling to the right when the fault occurs, the message will have a directional indicator to the right. If the piston is traveling to the left, the message will have a directional indicator to the left. The arrows can be very helpful in determining which side may be the cause of the problem. Refer to the Intensifier Cycling subsection of the High Pressure Water section of the manual. After correcting the situation resume normal operation of the pump.

5.4.3 Shutdown II Messages

Shutdown II messages indicate a severe fault that requires the motor and intensifier to be shut down. The red light will flash and one of the following fault messages will be displayed on the LCD screen.

- HYDRAULIC OIL LEVEL LOW
- MOTOR FAULT
- LOSS OF FRONT CONTROL PANEL

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Low Hydraulic Oil Level

The probe in the hydraulic oil tank has a float switch. When the oil level is too low, the float drops and the fault monitoring circuit is opened. To correct the situation, find out where the oil has gone. If the oil is in the catch pan at the bottom of the pump it should be fairly easy to find the leak. If it is not in the bottom of the catch pan, it could be leaking undetected through the heat exchanger. Or it could be that the oil was spilled during pump maintenance. Repair all leaks and fill the tank with the specified hydraulic oil to the top of the sight gauge. Press the ACK/RESET button to clear the fault and resume normal operation.

Motor Fault

The Wye-Delta motor starter in the pump electrical enclosure has a thermal overload module that senses the amount of current flowing through the main contactor. If this current has been exceeded for a length of time, the monitoring circuit is opened. To clear this fault, press the RESET button on the thermal overload module (see the Thermal Overload Protection information earlier in this section. You may have to allow time for the module to cool down before it can successfully be reset.

There are several reasons why this fault may be occurring. The most likely cause is too large a water demand. If an orifice has broken or plumbing is leaking water, demand may be high enough to cause the motor to overload. Reduce demand and reset thermal overload.

The next likely cause is that the thermal overload is on the wrong setting. The correct setting should be 53 Amps.

Another likely cause is that the Hydraulic Pressure Relief Valve is opening at too low a pressure. This situation usually but not always causes a rushing or whistling sound and the valve will become hot. See the hydraulic section for setting the Hydraulic Pressure Relief Valve. Set or replace the valve to fix the fault.

A less likely cause of this fault may be a bad hydraulic pump or a faulty motor. These conditions are very rare. Refer to the Motors information earlier in this section or to the Hydraulic Pump subsection of the Hydraulic Assembly section of this manual.

Loss of Front Control Panel

The communication with the control panel is the first fault condition monitored by the PLC. If the PLC senses loss of communication with the front control panel it will immediately shut down the motor and intensifier and flash the red light. This is the one fault condition where there will not be a message on the PLC screen. The most likely cause of this fault is an unplugged cable between the PLC and the LCD display. The fault may also be caused by a poor connection or a broken wire. Correct the problem and make sure the display is operating normally before resuming operation of the pump.

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Section 6

Low Pressure Water

6.1 Low Pressure Water Overview Assembly 11534

This section describes the components and operation of the following parts of the Low Pressure Water Assembly:

- Inlet cutting water supply for the HP intensifier assembly
- Cooling water inlet and outlet for the oil-to-water heat exchanger
- Drain water out from the leakage pans and the Bleed-Down Valve discharge.

There are four ¾" NPT couplings located at the rear of the pump for making these connections.

6.2 Inlet Cutting Water Supply

The inlet water cutting supply includes all the plumbing components from the pump inlet connection to the inlet to the intensifier. It includes the following:

- Inlet water shutoff valve (solenoid operated)
- Boost pump with bypass relief valve
- Low pressure water filters
- Pressure switch for sensing low pressure condition
- Quick disconnects to the intensifier

The boost pump housing and low pressure water fittings are stainless steel with rubber hoses connecting the low pressure water components.

The low pressure cutting water circuit can be used with inlet water quality as provided by water softening, reverse osmosis, or de-ionized water. Most installations with normal city water pressure will require no adjustment of the bypass relief valve. See Inlet Water Requirements in the Specification section of the manual for further information.

Two water gages are located on the front panel of the pump to show the pressure after the boost pump and the pressure after the filters. These are used to determine the pressure drop across the filters.

Quick disconnects are provided at the HP End Caps for ease of maintenance, preventing low-pressure water from spraying out when this connection is broken. A manual ball valve is provided to discharge the accumulator prior to changing filters.

The boost pump will automatically shut off after the intensifier has not cycled after a period of time. The pump automatically restarts when the intensifier shifts or the system water pressure drops below 40 psi.

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Operation:

The cutting water enters the pump through the port at the rear inlet connection. When the motor is turned on the inlet solenoid valve is energized allowing water to flow to the inlet of the boost pump. The boost pump increases the inlet pressure to assure proper supply to the intensifier. The water passes through three filters and an accumulator before entering the intensifier.

6.2.1 Boost Pump Assembly

The Boost Pump Assembly consists of the pump, a bypass relief valve, and a check valve. It operates by taking the inlet supply water and adding pressure based on the setting of the bypass relief valve.

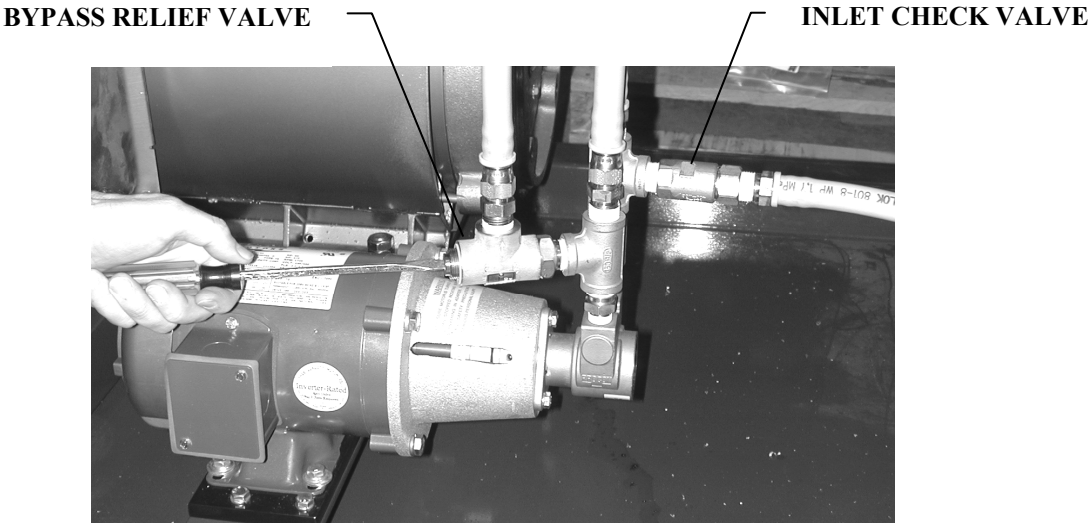
The pump has been set-up to operate with inlet water pressure of 20 to 70 psi. The bypass relief valve has been set to create a boost pressure of 45 psi. For example an inlet pressure to the pump of 50 psi will result in a boost pressure of 95 psi.

⚠ CAUTION **The inlet water components of the pump are rated to a maximum pressure of 125 psi. High inlet pressure may result in the boost pump creating excessive pressure and damaging components. If either of the panel gages reads over 125 psi, turn off the boost pump as explained below. In the unlikely situation that the inlet pressure to the pump exceeds 125 psi a pressure reducing valve must be added before the inlet cutting water enters the pump.**

Boost Pump Pressure Adjustment

Adjustment must be made with the pump turned off. It is factory set for inlet cutting water provided at normal pressures as provide by municipal water or well pumps. In the case where the pump is supplied by a tank such as on a reverse osmosis system it is necessary to increase the boost pressure.

The boost pump pressure relief valve is adjusted by removing the valve cap and turning the screw with a flat blade screwdriver. Turn clockwise to increase the pressure or counterclockwise to decrease pressure.



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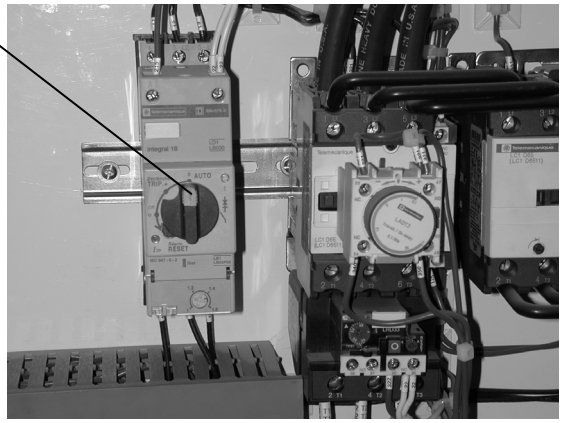
High Inlet Water Pressure

Inlet water pressure that exceeds 70 psi requires that the boost pump be turned off. Open the electrical cabinet and turn the switch located on the boost pump motor contactor to OFF.

BOOST PUMP ON/OFF KNOB



WARNING **The electrical cabinet contains high voltage. Extreme care should be used when working in this area. If you are unfamiliar with this area a qualified electrician should be used.**

Inlet Cutting Water System Protection

Low water pressure to the intensifier is sensed by a pressure switch located after the filters. A sustained pressure of below 40 psi will result in pump shutdown. This protects the system from running without enough feed pressure to the intensifiers.

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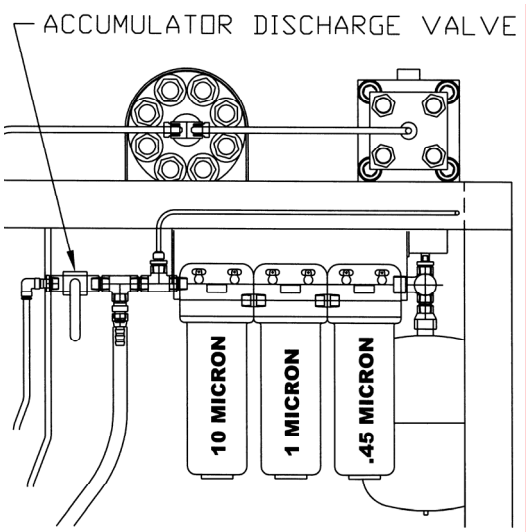
6.2.2 Inlet Cutting Water Filtration

In order to maintain necessary fluid pressure for the pump and to keep the water clean for proper operation it is necessary to replace the water filters periodically.



Water Filter Service

Replace filter elements when there is a 10 psi pressure differential between the two gages located on the pump control panel.

Replacement Parts:

11107 10 Micron Filter
11106 1 Micron Filter
11105 0.45 Micron Filter

Recommended Tools:

Strap Wrench for turning filter housing

Water Filter Element Replacement Procedure

a) Turn the pump off
b) Open the accumulator discharge ball valve to relieve trapped pressure
c) Unscrew the filter housing from head. Remove element.
d) Install new elements in the housing. Screw the housing into head.
e) Close the discharge ball valve.
f) Turn the pump motor on to turn on the inlet valve and boost pump.
g) Press the bleed valve located on the top of the filter housing to remove trapped air.
h) Start the waterjet pump. Verify satisfactory pressure readings.

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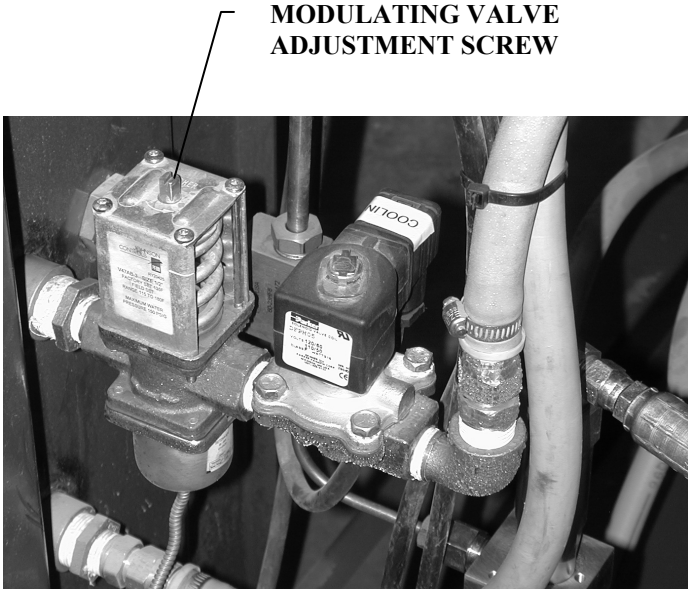
6.3 Cooling Loop

The cooling loop consists of an inlet solenoid valve to turn the water on when the motor is turned on and a water modulating valve to control the cooling water flow rate relative to the hydraulic oil temperature. A probe in the tank senses the oil temperature.

The modulating valve has been factory set so that approximately 2 gpm of water is used to maintain a hydraulic temperature under 100°F. Local air and water temperatures may require that the modulating valve be adjusted.

6.3.1 Water Modulating Valve Adjustment

The oil temperature in the hydraulic tank should not exceed 110°F. The tank temperature can be seen on the temperature/level gage located on the front of the hydraulic tank. High hydraulic oil temperatures can adversely affect oil life and high pressure seal life.



Adjustment Procedure:

If the oil temperature is over 110°F
Turn the screw ¼ turn clockwise to reduce oil temperature
Wait 15 minutes and look at oil temperature
Repeat procedure until oil temperature is below 110°F

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Section 7

High Pressure Water

7.1 High Pressure Water Overview

The high pressure (HP) water system takes the relatively low pressure water inlet up to 60,000 psi (4137 bar) with a maximum flow rate of 1.6 gallons per min (6.1 liters per minute) and a maximum orifice diameter of 0.018" (0.45 mm).

High Pressure Assembly 11537 consists of the following major components:

- **Intensifier Assembly 11501** uses hydraulic power to reciprocate the center hydraulic piston. Connected to each side of the piston is a plunger. The two plungers reciprocate in the high pressure cylinders to make the high pressure water. Each side of the intensifier has one low pressure and one high pressure check valve to bring in inlet water and output high pressure water.
- **Bleed-Down Valve Assembly 11480** discharges high pressure water from the pump when the pump is turned off or when the hydraulic pressure is reduced.
- **Attenuator Assembly 11595** acts as an accumulator by using the compressibility of the water to dampen the output water pressure pulsation caused by the reciprocation of the intensifier.
- **HP Filter Assembly 11598** is normally located at the pump output or at the upstream end of the whip for the cutting head.

Detailed instructions are provided on disassembly and reassembly of the hydraulic intensifier, including HP seal maintenance. A discussion of detailed inspection and repair for individual HP subassemblies is also provided. HP attenuators are discussed but no disassembly procedures are included since attenuators are not serviceable by the customer.

⚠ WARNING **High pressure water may be stored in the HP plumbing. Water pressure must be discharged through the Bleed-Down Valve before starting any service or maintenance. Stay clear of weep holes when unscrewing HP fittings in case pressurized water is discharged. Turn off electrical power and relieve all water and hydraulic pressure prior to service. Proper lockout/tag out procedures must always be followed prior to performing any maintenance.**

7.2 Intensifier

In addition to normally used tools the following special tools are required:

- 300 foot-pound torque wrench with ¾" square drive
- 11557 Seal Insertion Tool Assembly
  (Includes 1 each of 11812 Push Tool, 11811 Sleeve Guide, 11550 Locating Ring)
- 11985 Seal Housing Removal Tool
- 12021 1 ½ Hex x ¾" Square Drive Socket
- 12020 ¾" Hex x ¾" Deep Square Drive Socket
- 12019 ¾" x 13.5" Hex Driver
- 11448 High Pressure Food Grade Lubricant

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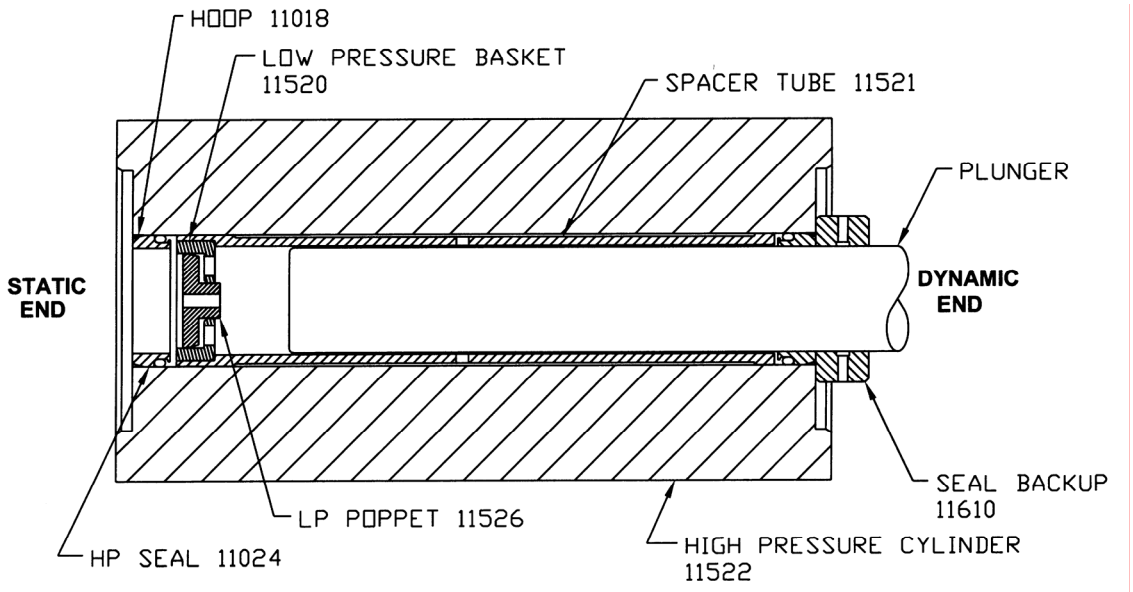
Due to the high forces inside the intensifier all bolts and cap screws that fasten the load carrying components are Grade 8. Fasteners exposed to cyclic loading use lock washers. Unless otherwise noted, when reassembling, torque the load carrying fasteners to the values given in the Bolt Torque section of this manual.

Care must be taken to keep the interior parts and surfaces clean. Parts should be placed on clean work surfaces and hands should be washed and kept clean while changing HP components such as HP seals. Before reassembling any high pressure or hydraulic components verify that any dirt or other contaminants have been wiped clean.

7.2.1 High Pressure Seal Removal

Replacement of the high pressure seals and hoops is the most common service function. Water dripping from either end of the HP Cylinder indicates that the seals may soon require changing. One drip every few strokes means that the seals should be watched. More than one drip with each stroke means that the seals in that HP cylinder should be changed at the first opportunity.



a) Remove the high pressure tubing and inlet water quick-disconnects from the appropriate end of the intensifier.
b) Remove the four 1” nuts from the studs by using a cross pattern to gradually unload the high pressure end cap from the high pressure cylinder.
c) Remove the HP End Cap and the Check Valve Body from the HP Cylinder.
d) Remove the HP Cylinder from the Plunger and the LP Poppet from the static end of the HP Cylinder. (Note: the dynamic end of the cylinder is the end towards the intensifier center and the static cylinder end is the outboard side and contains the LP poppet.).

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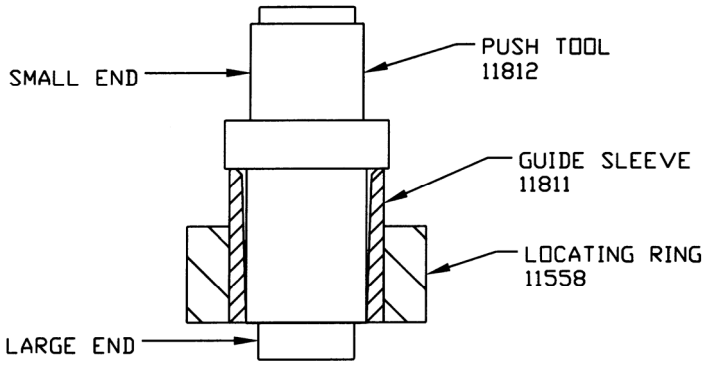

e) Place the dynamic end of the cylinder on the seal tool Locating Ring. With the small end of the Push Tool use a rubber mallet to drive the bottom seal and hoop out of the HP cylinder. Flip the cylinder over and repeat the process. The seals, hoops, spacer tube and low pressure poppet cap should now be free of the HP cylinder.

f) Remove the Seal Backup from the Seal Housing in the hydraulic end cap. It may be necessary to partially remove the Seal Housing. See Hydraulic Seal Housing section for removal instructions.
g) Clean and inspect all disassembled parts. If the bronze back-up is to be reused verify that the weep hole and ID groove are clear. See 8.2.3 for reconditioning of the HP cylinder and 8.2.4 for reconditioning of the check valves.

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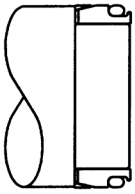
7.2.2 Installing New HP Seals

Use 11451 Seal Kit which includes:
4 of 11024 HP Seal with o-ring, 4 of 11018 Hoop and 1 of 11447 Grease Packet
Also use 11610 Seal Back-up

a) Apply grease from the packet onto each o-ring. Place each o-ring onto the HP seal while making sure that the o-ring does not twist.
b) Put the Locating Ring and Seal Guide on the end of the Cylinder. The large ID end of the Seal Guide should be up. Coat the inner diameter of the Seal Guide with the packet grease.
c) Place the HP Seal and the Hoop onto the large end of the Push Tool. Note in the picture below the orientation of the seal and hoop.



d) Push the Tool by hand down into the Seal Guide. When the seal and hoop bottom in the taper, strike the top of the Push Tool with a rubber mallet to fully load the seal and hoop.

e) Flip the cylinder over and install the Spacer Tube and Low Pressure Poppet Basket.
f) Install another seal and hoop as described above.
g) The Seal Back-up can be reused once. Either install a new backup or reuse the old one. It may be necessary to pull the Seal Housing out slightly to access and remove the Backup. (See the Hydraulic Seal Housing section below)
h) Push the HP Cylinder onto the plunger. Make sure the low pressure poppet end of the cylinder is out. Press the Cylinder with the palm so that the seal and hoop do not pop out.

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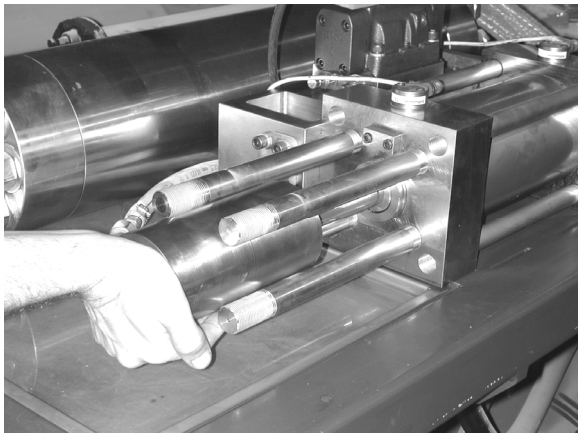
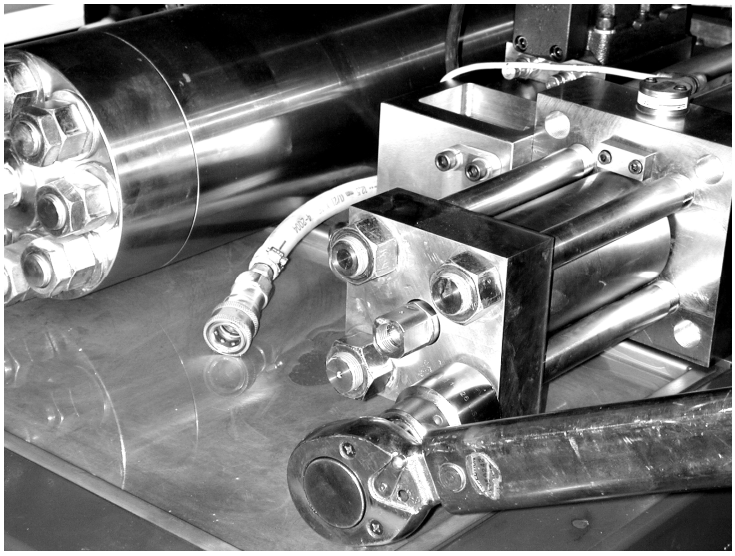


i) Place the Low Pressure Poppet in the basket. Do not apply lubricant in this area.
j) Put high pressure lubricant in the pilot bores on either end of the HP Cylinder.
k) With the Check Valve Body in the High Pressure End Cap, push the check valve into the ID of the HP Cylinder.
l) Using two 1" Nuts located diagonally lightly torque the HP End Cap so that it is bottomed onto the HP Cylinder.
m) Torque the 1" nuts in a cross pattern to **275 foot pounds**. Start at 125 ft-lbs and advance in 50 ft-lb increments. The stud threads should be greased with multi-purpose lithium grease such as Lubriplate No. 1552.



n) Reattach the high pressure plumbing.
o) Turn the inlet water on and open a cutting head. Allow the pump to cycle slowly at low pressure for a few minutes to ensure that the seals seat properly before returning to operating pressure.

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7.2.3 High Pressure Cylinder

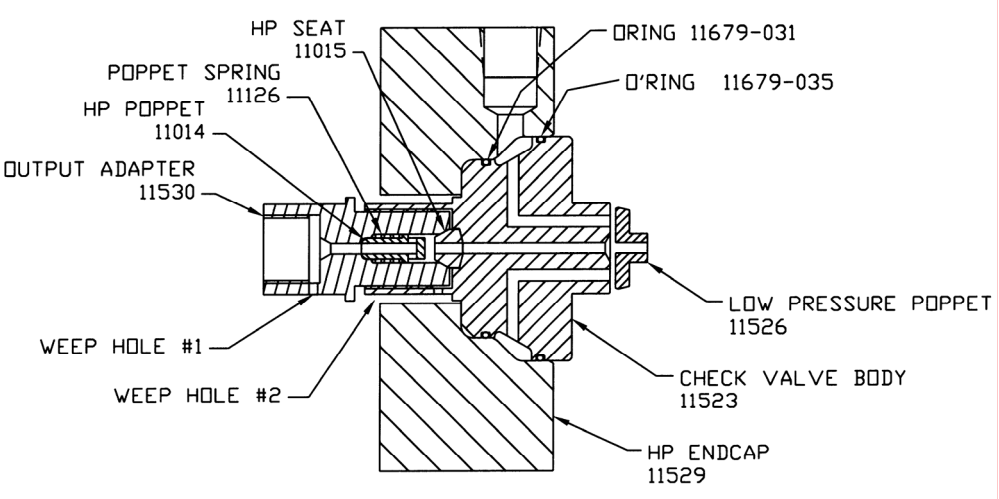
During use the inner surfaces at the ends of the HP Cylinder may become worn. To clean this area roll polish the ID of the cylinder ends on a table. First use 180 grit or finer abrasive paper then use Scotch-Brite.

HP Cylinders may eventually fail due to fatigue leading to a crack or the ends may open or bell out so that the cylinder does not hold the seal and hoop properly. If the cylinder is cracked the cylinder will be hot, water may squirt with each stroke, and the failure may appear to be a seal failure. A belled out cylinder end will cause the premature failure of the seal and cause the hoop to break.

7.2.4 Check Valve Assembly

Check valve replacement and reconditioning is the second most common intensifier maintenance function. The Low Pressure Check Valve allows inlet water to enter the HP cylinder and the High Pressure Poppet lets the pressurized water from the HP cylinder exit the intensifier. Over time the faces of the poppet, seat and check valve body may become worn. Check valve repair involves replacing the HP Poppet, HP Seat, Poppet Spring, LP Poppet and lapping the face of the Check Valve Body.

Check valve repair may be necessary when the HP End Cap area becomes hot to the touch or the intensifier strokes faster in one direction without seal leakage.



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Weep Hole Leakage (See Previous Figure)

Weep Hole #1 leakage means that the inlet fitting needs to be tightened into the Output Adapter. Weep Hole #2 leakage means that the Output Adapter needs to be tightened into the Check Valve Body.

Check Valve Replacement and Reconditioning

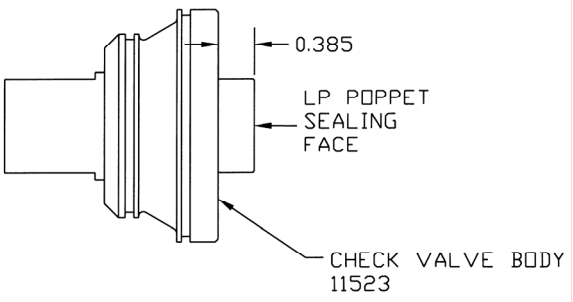
Use Poppet Kit 12024 which includes: 1 of 11014 HP Poppet, 1 of 11015 HP Seat, 1 of 11126 Poppet Spring, 1 of 11526 LP Poppet, 1 of 11679-031 o-ring and 1 of 11679-035 o-ring.
Also use 11448 High Pressure Lubricant.

a) Remove the HP End Cap from the HP Cylinder as described in above section on High Pressure Seal Removal.
b) Unscrew the Output Adapter from the Check Valve Body and remove and discard the HP Poppet, Poppet Spring and the HP Seat.
c) Inspect the low pressure poppet face of the Check Valve Body. A worn face indicates that it should be lapped as described in the section below.
d) Apply HP Lubricant to both sides of the HP Seat and place the seat in the cavity of the Check Valve Body.
e) Install the Poppet Spring and HP Poppet into the Output Adapter and tighten the adapter into the Check Valve Body.
f) Replace the o-rings on the outside of the Check Valve Body.
g) Replace the LP Poppet in the Poppet Basket located in the static end of the HP Cylinder. Do not put lubricant here as it may prevent the LP Poppet from moving freely.
h) Reassemble the end of the intensifier as described above in Installing New HP Seals.

Lapping Procedure for the Check Valve Body Face

During use the CV Body face becomes worn from the action of the LP Poppet. It may be indented from repeated poppet impact or have erosion tracks. It is necessary to periodically inspect this surface and if necessary return it to a flat and near mirror finish. This procedure is for a moderately worn CV Body face. Severe wear will require that the face be turned in a lathe or ground on a precision surface grinder prior to lapping.

Repeated lapping may shorten the Check Valve Body's sealing diameter length so that it is not usable. If the length is less than .385" as shown below it should be replaced.



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The following items are required:

- Granite Inspection Plate at least 9” x 12”
- 8.5” x 11” Sheets of 320 grit SiC abrasive paper
- 11210 Lapping Film

When the Sealing Face has slight indentations it is necessary to only lap with the 11210 lapping paper. Deeper indentations require that it first be lapped with the SiC abrasive paper. The procedure follows:

a) Place either the abrasive paper or lapping film on the granite plate and tape with masking tape around the edges.
b) Move the Check Valve Body on the film or paper back and forth without rocking. It must remain flat. After each movement rotate the CV Body approximately 45 degrees so that it is evenly finished.

c) Lapping is complete with the abrasive paper when the face has an even appearance and any indentations are removed.
d) Lapping with the lapping film is complete when the face is flat with a near mirror finish.

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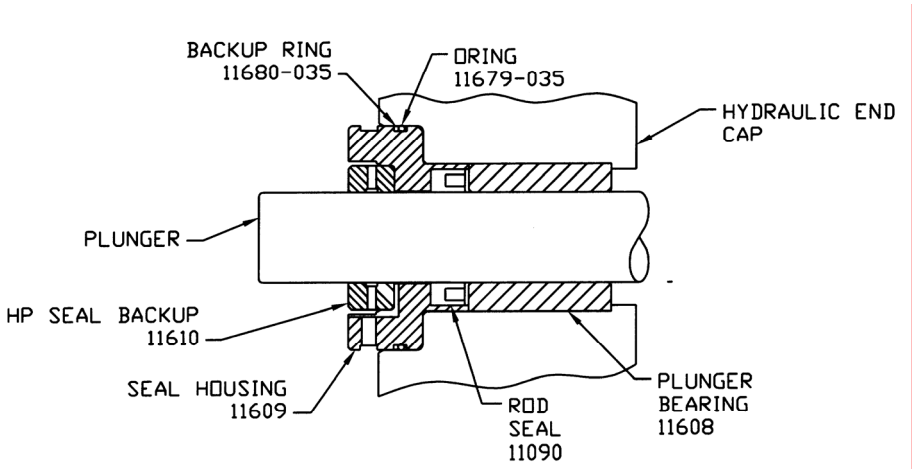
7.2.5 Hydraulic Seal Housing

Removing the Hydraulic Seal Housing provides access to the Rod Seal. If oil is observed in the seal area during HP Seal replacement the Rod Seal should be replaced.



a) With the HP Cylinder removed slide the 11985 Seal Housing Removal Tool over the exposed Seal Housing diameter and into the groove.
b) Jack the Seal Housing out using the two screws on the tool and pull the seal housing off the plunger.
c) Remove the old seal and install a new Rod Seal in the Seal Housing. Note the direction of the Rod Seal in the Housing.
d) Inspect the condition of the HP Seal Backup and flip or replace as necessary. ID corner chipping or loose fit on the plunger are cause for change.
e) Replace the o-ring and backup on the OD of the Seal Housing. Position the o-ring on the rod seal side of the groove and Backup on the backup side of the groove. The backup is contoured on one side and this side is toward the o-ring,

f) Apply HP Lubricant to the outside of the o-ring and to the ID of the rod seal.
g) Using the palm of the hand push and rotate the Seal Housing on the plunger end until it goes on.
h) Slide the Seal Housing by hand until it stops.
i) Complete the New HP Seal installation by pushing the Housing in completely.

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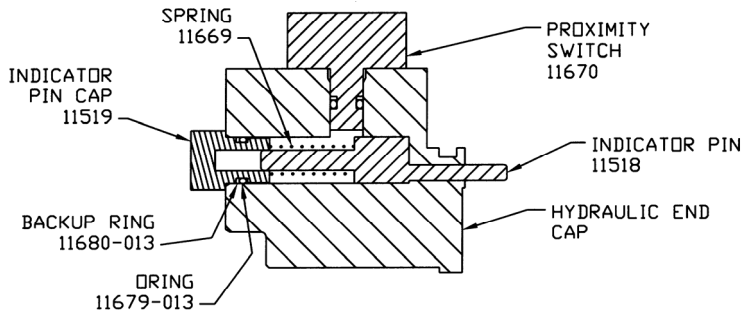
7.2.6 End of Travel Sensing

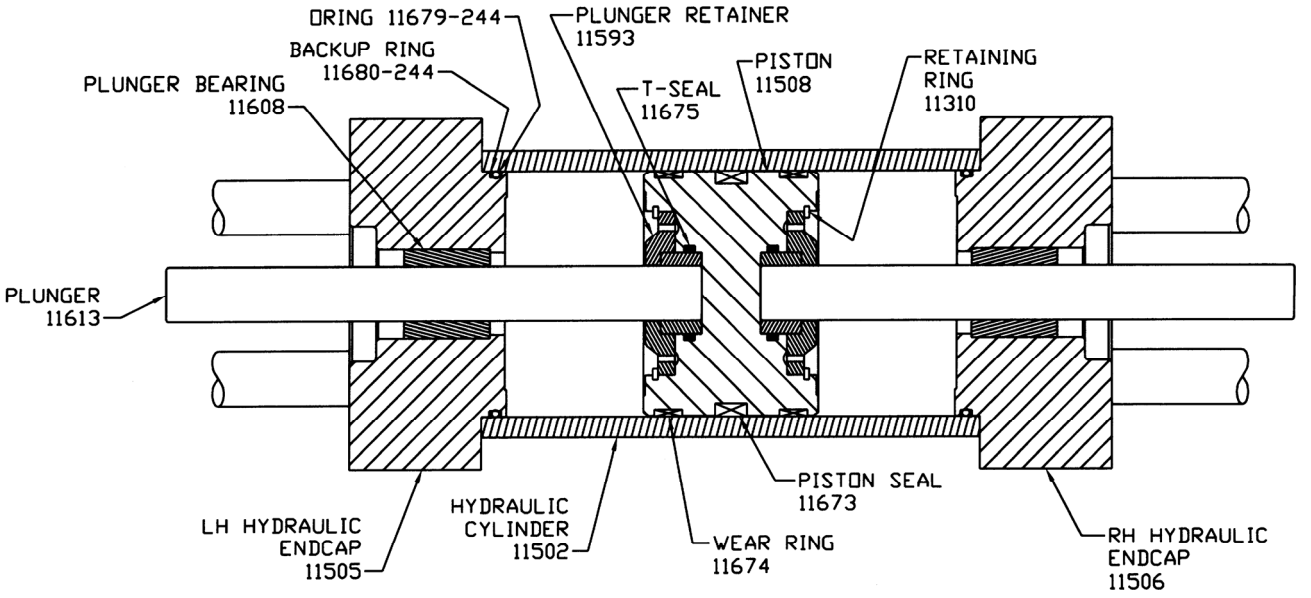
The Indicator Pin transfers the motion of the hydraulic piston at the end of travel for sensing by the proximity switch. The Pin can be accessed by removing the Indicator Cap from the End Cap



The pin should move freely in and out all the way to the bottom of its travel. Reassembly of the Indicator Pin Cap and Proximity Switch requires appropriate torque.

7.2.7 Hydraulic Center Section

The Hydraulic Center Section houses the Piston and the Plungers. Service in this area is infrequent. This section describes the service of this area with the HP Cylinders removed and the Center Section removed from the pump and serviced on a work bench.



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Disassembly

a) Unscrew the eight bolts in the back of the manifold that connect it to the end caps.
b) With the HP Cylinders removed loosen but do not remove the four 7/8 cap screws that preload the two Hydraulic End Caps together. Use the ¾" Hex x ¾" Deep Square Drive Socket and the ¾" x 13.5" Hex Driver.
c) Unscrew and remove the four bolts under the Hydraulic End Caps that secure the intensifier assembly to the frame.
d) Place the Center Section on a clean work bench and remove the four 7/8" cap screws. Cover the manifold oil ports to prevent contamination.
e) Pull the End Caps off the Hydraulic Cylinder. This will take two people.

Plunger Replacement

After extended use the plunger surface may become damaged and/or scored

a) Push the Hydraulic Piston to the end of the Hydraulic Cylinder so that the plunger is accessible. Use a rubber mallet to drive the opposite plunger end. Do not remove the piston from the cylinder. Special tooling is required to reload the piston into the cylinder.
b) Use locking snap-ring pliers on the Retaining Ring and remove the Plunger Retainer and Plunger.
c) Replace the T-Seal and its backups. The inner diameter of the backup has a corner radius that is towards the T-Seal. The angle cut ends of the backup must overlap properly.
d) Squirt a small amount of hydraulic fluid in the bottom of the piston cavity and lubricate the T-Seal.
e) Push the new plunger into the T-Seal, replace the Plunger Retainer and reinstall the Retaining Ring.

Piston Seal and Wear Ring Replacement

The Piston uses a long life capped T-Seal and Wear Rings for the longest possible life. After extended use the intensifier may not be able to stroke as fast and the pump may generate heat. This is a sign that the Piston Seal is bypassing oil and needs to be replaced. Special tools are required to load the new seal on the piston and load the new piston/seal assembly into the hydraulic cylinder. Contact Accustream Service for further information regarding this procedure.

Plunger Bearing

The Plunger Bearing may become worn and may lose its precision fit relative to the plunger. The bearing should be replaced if the plunger fit is too loose. A bearing ID measurement of .0015" greater than the plunger diameter is too loose. The bearing is easily changed when the hydraulic end cap is off the hydraulic cylinder.

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Reassembling the Center Section

a) Verify that all surfaces are clean and free of contamination.
b) Replace the o-ring and backup on the end cap. Place the o-ring on the side of the groove towards the piston and the backup on the side away from the piston. The concave side of the backup is towards the o-ring. Lubricate the o-ring with hydraulic oil.
c) Install the Plunger Bearings in the End Caps.
d) On a flat clean surface slide the Hydraulic End Caps into each end of the Hydraulic Cylinder.
e) Thread the four 7/8" cap screws in and lightly pull the end caps against the hydraulic cylinder until they bottom-out. The cap screw threads should be greased with a multi-purpose lithium grease such as Lubriplate No. 1552.
f) Prior to torquing the 7/8" cap screws the center section must be secured with the manifold mounting face clamped to a flat surface. Either clamp it to a flat work surface or bolt it back to the manifold first and then to the frame on the pump before applying torque.
g) Torque the 7/8" cap screws in a cross pattern to **275 foot pounds**. Start at 125 ft-lbs and advance in 50 ft-lb increments.
h) The eight bolts that connect the manifold to the hydraulic end caps must be torqued to the appropriate value as given in the Fastener Torque section of this manual.
i) Reassemble the end of the intensifier as described above in Installing New HP Seals.
j) Loosen the four bolts that secure the intensifier to the frame when reconnecting the HP tubing. This allows it to float into the correct location. Tighten the four frame connect bolts.

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7.3 Intensifier Cycling

Normally the intensifier cycles at the same speed in both directions smoothly. Leaks or HP component failures will cause the intensifier to Over Cycle in one or both directions. Severe over cycling will cause a fault condition, pump shutdown and the over cycle direction will be indicated by an arrow on the display screen.

If an over cycle shutdown or harsh cycling occurs it is important to observe the pump operation before attempting to fix the problem. Turn the pump and intensifier on at a reduced cutting pressure of 1000 psi hydraulic pressure and gradually increase the pressure until the nature of the problem is seen. Look for leaks and use the proximity switch lights to determine which direction the intensifier is over cycling.

7.3.1 Intensifier Over Cycling Equally Both Directions

- This is most likely caused by a leak. Check the tubing and fittings inside and outside the pump and fix any leaks. Check the Bleed Down Valve. If it feels hot or if water is coming out the pump drain line then the Bleed Down Valve should be rebuilt with a new kit.
- A blown orifice at the cutting head will increase the HP water requirements.
- The intensifier water inlet could be starved without setting off the low pressure alarm. Check the quick disconnects to the intensifier.

7.3.2 Intensifier Over Cycling One Direction

- This indicates a problem inside the intensifier, specifically the HP Cylinder or HP Check Valve area.
- Verify that the water inlet connection is made to the intensifier.
- Look for leaking from either end of the HP Cylinder. Replace HP Seals if necessary.
- If the HP Cylinder or Check Valve Body is hot disassemble and look for cracks. If a component is cracked it must be replaced.
- If there are no visible leaks then the likely cause is that one of the poppet and seat areas is bypassing water. This is a good time to inspect both of the HP Poppets and Seats and both LP Poppets and the Check Valve Body face. Replace and/or recondition the damaged poppet faces.

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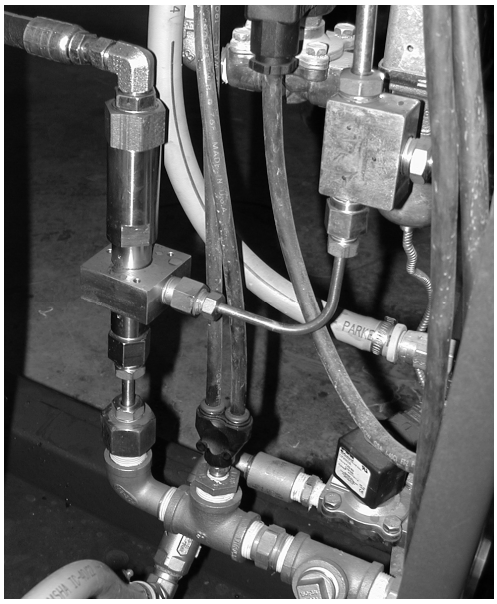
7.4 Pump Bleed-Down Valve

The Bleed-Down Valve discharges high pressure water from the pump when the pump is turned off. It operates as a normally open safety valve and is controlled by a hydraulic solenoid valve. It is located inside behind the utility panel at the rear of the pump.



Use 11331 Bleed-Down Valve Repair Kit which consists of one each of the following:

- 11359 Oil Seal
- 11323-Seal Hoop
- 11322-Needle(Stem)
- 11321- HP Seal
- 11324-Bushing
- 11325-Seat
- 11447-Grease Packet
- O-rings: 12027-12,12027-08, 11679-114
- Back-up Ring 11680-114

Also use the 12029 Bleed-Down Valve Tool

Kit installation procedure:

a) Shut down the system.
b) Remove the hydraulic hose from the Bleed-Down Valve and gland nut connection from the water drain tubing to the Bleed-Down Valve.
c) Remove the gland nut from the collar at the high-pressure port of the Bleed-Down Valve.
d) Disconnect the actuator from the high pressure valve assembly. Remove all the hydraulic fittings from the Actuator Housing.
e) Remove the adapter from the Bleed-Down Valve Body. Remove and discard the HP Seat.
f) Remove the kit components from the valve body by using the pin end of the BDV Tool. Take the pin and push through the Oil Seal which pushes on the HP Stem. Note: Do Not Remove Oil Seal.

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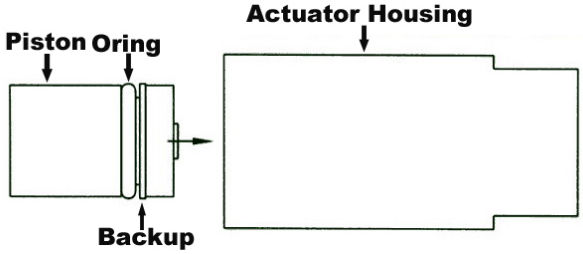
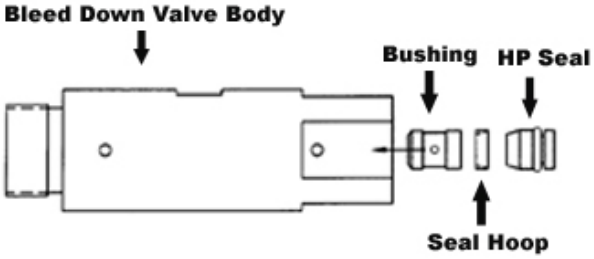
g) Inspect the Oil Seal for damage. If it appears damaged, remove with a pick and press in the replacement using a Vise or small Arbor Press.
h) Push the piston out of the actuator body through the oil port. Discard the o-ring and backup ring from the piston.
i) Clean all parts before new parts are inserted.



j) Lubricate the o-ring and backup ring with Grease from packet. Install the piston assembly carefully into the actuator body until seated securely so that no damage is caused to the o-ring.
k) Using HP Lubricant (11448) lubricate the Stem, Seal, Seal Hoop, and Bushing.
l) Place the Bushing, Hoop and Seal on the stepped diameter end of the BDV Tool in the order as shown below. Use HP lubricant to lubricate the OD of the parts to be inserted.



m) Push the kit parts in until the Tool bottoms on the Valve Body.
n) Apply HP Lubricant to the Stem and insert the tip into the Oil Seal side. Push the Stem until it goes through the Seal assembly and bottoms out.
o) Grease with HP Lubricant and install the HP Seat into the bottom of the Bleed-Down Valve body with the pointed end down. The narrow end fits into the adapter. (When installing the adapter Torque to 35ft-lbs.
p) Connect the high pressure valve assembly to the actuator body. Reinstall the Bleed-Down Valve in the machine by attaching the gland nut to the high pressure collar at the high pressure port of the valve. Torque nut to 35 ft-lbs.
q) Install the gland nut connecting the water drain tubing to the Bleed-Down Valve. Reattach the hydraulic hose to the oil port of the Bleed-Down Valve.
r) The intensifier is ready for use. Turn on and check for any leakage.

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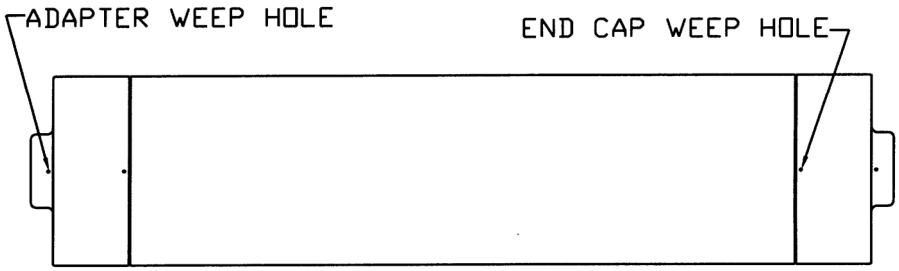
7.5 Attenuator

The Attenuator uses 9/16 male x 3/8 female inlet adapters on either end to connect to the 3/8" HP plumbing in the pump. Leakage from the inlet adapter weep holes can be addressed by tightening the adapters into the Attenuator End Caps.

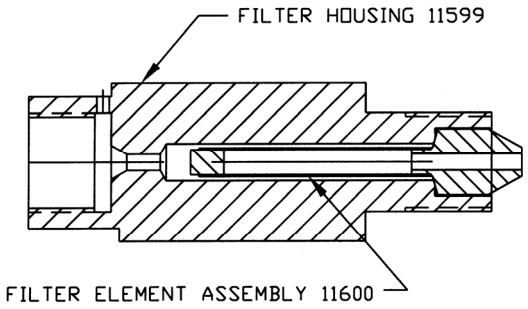


END STUDS AND NUTS NOT SHOWN

Leakage from the End Cap Weep Hole or the gap between the End Cap and the Attenuator Body is not serviceable by the user. If leakage persists from this area contact Accustream Service for further assistance.

7.6 High Pressure Filter Assembly

The HP Filter Assembly is normally located at the output of the pump. It consists of a screen filter element that should be replaced on a regular basis. See the Recommended Maintenance Interval section for replacement timing guideline. Better or lesser quality water than is normal may increase or decrease the duration between replacements.



HP Filter Assembly 11598

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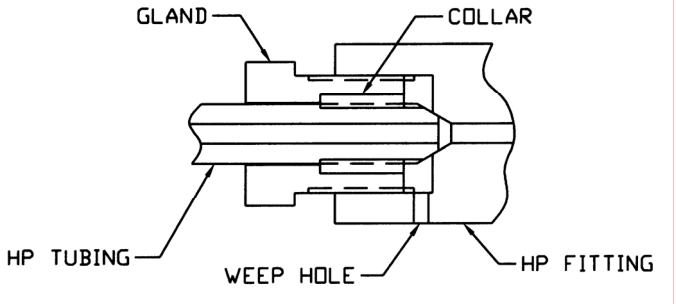
7.7 High Pressure Plumbing

Weep holes throughout the UHP water system relieve water seepage from leaking components. Seepage from any of the holes indicates a faulty component, loose connection, or damaged seat. Failure to correct the cause may result in damage to the mating fittings.

If weep hole leakage is observed the fitting may have loosened and require tightening. Another cause of seepage is that the collar on the tubing needs to be threaded onto the tubing further. Persistent seepage requires that the fitting or tube should be replaced.



High pressure fittings should be lubricated with HP grease. Use two wrenches to tighten, one on the gland and one on the fitting, to minimize side load.

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Section 8

Hydraulic

8.1 Hydraulic Overview

Hydraulic pressure and flow from a pressure compensated variable displacement (PCVD) piston pump is passed through the spool valve and is directed to either side of the hydraulic piston in the intensifier. The intensifier reciprocates and creates high pressure water as output.

The hydraulic pump pressure is controlled by the Control Manifold Assembly. It is connected to the pressure compensator port of the pump. The control manifold has two pressure control valves for either cutting pressure or pierce pressure. When the pump is turned off a solenoid valve in the manifold opens and the hydraulic pressure goes to its minimum.

The hydraulic oil is filtered and cooled through a separate "kidney loop". Oil is drawn from the hydraulic tank through a gear pump mounted to the end of the PCVD pump. The oil then passes through the filter and heat exchanger before returning to the hydraulic tank.

⚠ WARNING **Before starting any service or maintenance, turn off electrical power and relieve all water and hydraulic pressure. Proper lockout-tag out procedures must always be followed prior to performing any maintenance of the unit.**

8.2 Hydraulic Oil

This section describes the quantity and type of oil required and how to change and add oil.

8.2.1 Hydraulic Oil Requirements

The pump requires forty gallons of ISO VG 32 mineral oil.

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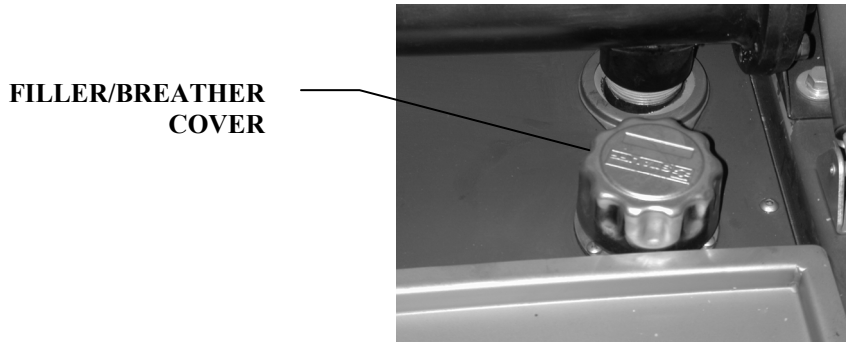
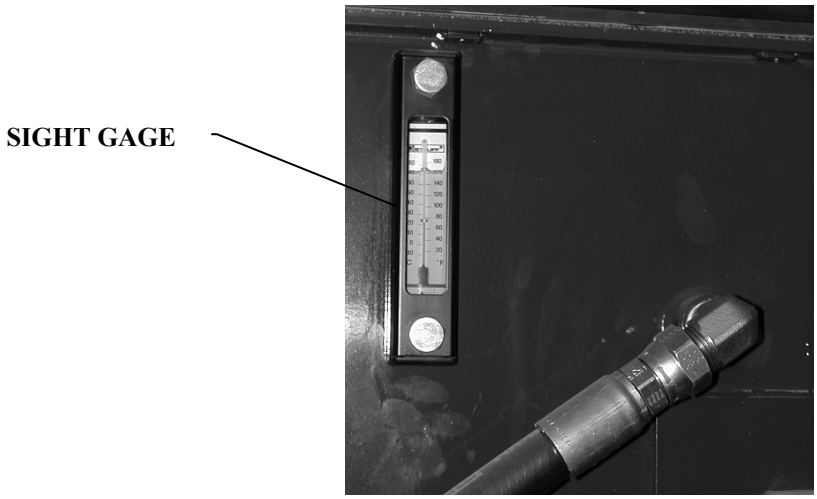
8.2.2 Adding New Hydraulic Oil

a) Verify that the ball valve on the bottom of the hydraulic tank is closed.
b) Unscrew the filler/breather cover on top of the hydraulic tank.



c) Fill with the appropriate oil until the oil level is visible at the top of the sight gage at the front of the hydraulic tank.



d) Replace the filler/breather cover.

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8.2.3 Evaluating Old Hydraulic Oil

Hydraulic oil may need to be replaced after extended use or if it has been contaminated with water. Oil quality can be evaluated visually, by smell or measured by the oil supplier.

Water can be injected into the oil from the dynamic water seal in the intensifier. A badly leaking dynamic water seal can squirt water past the rod seal into the oil. (See the High Pressure Section) A milky oil appearance indicates that there is water in the oil. This can damage the hydraulic pump and requires that the pump be shut down immediately, all oil drained and components cleaned, replacement of oil, and replacement of the dynamic seal and rod seal.

Running the pump at too high of oil temperature will shorten the oil life. Recommended oil temperature is under 110ºF but not less than 70 ºF. The pump will give a high temperature warning at 130 ºF and shutdown at 150 ºF. See the Low Pressure Section for instructions on adjusting the water modulating valve.

New oil is almost clear and has no odor. After running at excessive temperature the color will darken and its smell will worsen. When the color is like dark honey and with a poor odor it is time to replace the oil.

8.2.4 Oil Replacement Procedure

Changing the oil is an opportunity to thoroughly clean the hydraulic system.

Requires:
1 of 11960 2 ½”Suction Strainer
1 of 11961 1 ¼”Suction Strainer
1 of 11245 Filter Element

a) Use new oil provided by your supplier
b) Drain the oil from the hydraulic tank using the ball valve at the bottom of the tank.
c) Remove the right pan over the hydraulic tank.
d) Remove the top cover of the hydraulic tank.
e) Remove and discard the two suction strainers in the tank.
f) Thoroughly clean the tank interior. Make sure no particulates remain on the bottom.
g) Install two new suction strainers. DO NOT use Teflon tape or pipe dope.
h) Drain the oil in the hydraulic hoses by disconnecting one end.
i) Reinstall hoses.
j) Replace the oil filter element. (See the Filter Section that follows).
k) Close the ball valve drain and reinstall the tank top cover.
l) Fill the hydraulic tank with new oil.
m) Let the oil sit until any bubbles dissipate.
n) Replace the right pan.
o) Start the pump at low pressure and check for hose leaks.

In the case of severe contamination such as with water it is necessary to drain and clean out other areas such as the shift valve, main manifold and the hydraulic pump.

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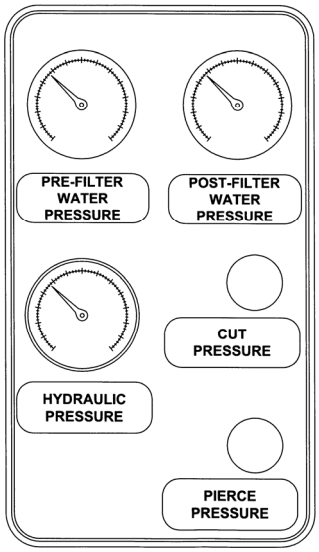
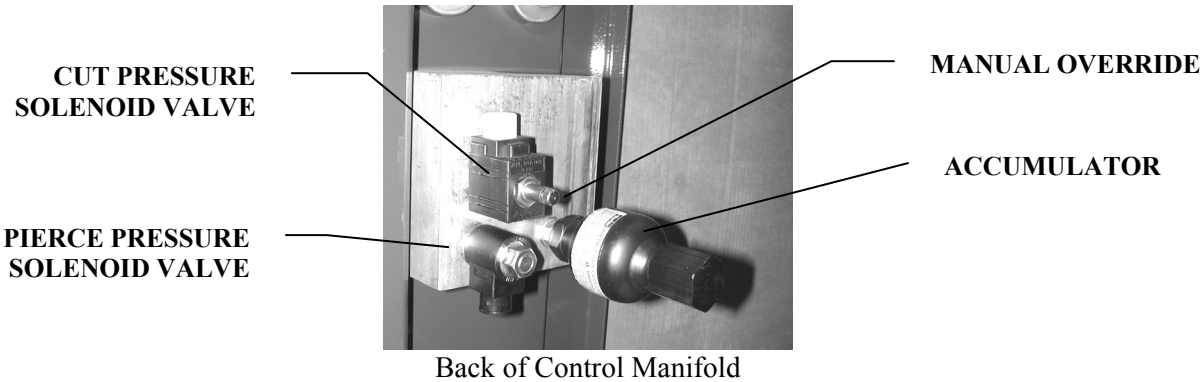
8.3 Control Manifold

The Control Manifold consists of two solenoid valves for high or low pressure selection, two pressure control knobs for setting of the high and low pressures, a small accumulator, and a gage for the hydraulic pressure. The Control Manifold connects to the pump compensator port and has a connection to the hydraulic tank



8.3.1 Cutting Pressure Knob and Pierce Pressure Knob

These two knobs are located on the front of the Control Manifold and are used to adjust the cutting and pierce pressures. See the Operation Section for instructions on setting the operating pressure.



Back of Control Manifold

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8.3.2 Cut Pressure Select Solenoid Valve

The Cut Pressure Select Solenoid Valve is located on the back of the Control Manifold directly behind the Cut Pressure Knob. This is a normally open valve. In case of loss of power it will discharge pressure from the hydraulic system and cause the bleed-down valve to relieve high pressure water. It has a manual override. In the case where the solenoid coil fails the valve can be manually turned on until the coil is replaced.

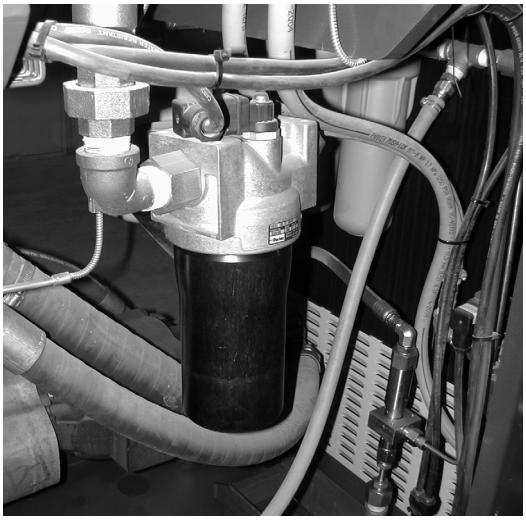
⚠ WARNING **Using the Cut Pressure Select Manual Override will prevent the discharge of hydraulic and water pressure at shutdown. Pump pressure ramp-up will be abrupt. This feature should only be used as a temporary feature until a new solenoid coil is installed.**

8.3.3 Hydraulic Gage

The hydraulic gage shows the operating pressure of the system. It is also used to determine the current cutting water pressure. Multiply the gage value by the intensification ratio of 19.25 to get the current water pressure. For example: with a gage pressure of 3000 psi the output pressure is about 57,000 psi.

8.4 Oil Filter

The gear pump takes oil from the hydraulic tank and directs it through the filter. The filter element should be changed when the oil is changed or at the maintenance interval given in the Maintenance Section.



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Filter element replacement procedure:

Requires 1 of 11245 Filter Element

Unscrew the bottom of the filter housing from the top using the wrench flats at the bottom. Discard the oil in the bottom housing and the old filter element. Install the new element with the closed end down and thread the bottom housing back into the top part of the filter housing.

8.5 Heat Exchanger

After the oil passes through the filter it goes through the heat exchanger for cooling before it returns to the hydraulic tank. The heat exchanger has been set up with the cooling water modulating valve as described in the Low Pressure Water Section of this manual.

Coolant for the heat exchanger may be water from a municipal water supply or be antifreeze-based from a chiller or an in-house cooling system. If the coolant is water that originates from a well it will likely be high in total dissolved solids (TDS) which can lead to clogging and loss of efficiency of the heat exchanger.

It is recommended that if the cooling water is high in TDS specifically calcium that the water be softened prior to entering the heat exchanger.

If the hydraulic system is warmer than in the past it is possible that the heat exchanger is partially clogged. The solution is to rod the tubes inside the heat exchanger to clear the obstruction or to install a new replacement.

8.6 Hydraulic Tank

The hydraulic tank has the following features:

- Epoxy Painted interior for corrosion resistance
- Sight gage and thermometer for seeing the oil level and its temperature
- Filler/breather cap keeps the contents of the tank free of airborne contamination
- Level sensor with temperature switches monitor the tank for low level and high temperature alarm conditions
- Inlet suction strainers prevent contamination from reaching the main PCVD pump and the kidney loop pump

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8.7 Main Pump Setup

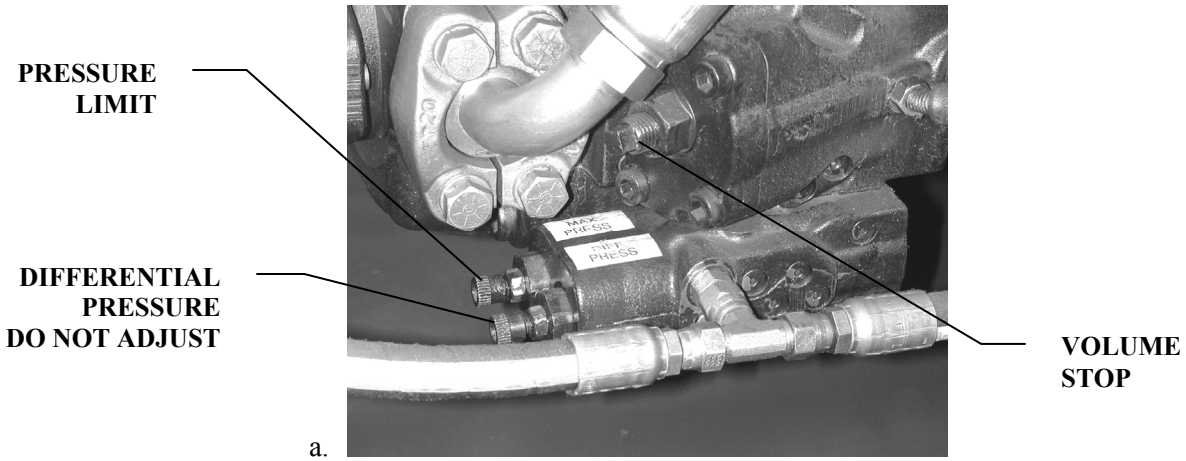
Procedure to setup a new or existing hydraulic pump after the hydraulic pump has been installed onto the motor adapter

8.7.1 Setting the High Pressure Pump Limit

IMPORTANT **This procedure should be performed only after a new hydraulic pump has been installed. Changing the adjustments on a tuned pump may cause adverse effects in the system.**

a) Disable the intensifier using the LCD display. (See the Operation Section for details)

b) Press the MOTOR ON pushbutton and then the INTEN ON pushbutton.



a.

c) Turn the Cut Pressure Knob clockwise to make the Hydraulic Pressure 3200 psi. THE INTENSIFIER SHOULD NOT CYCLE.

d) If the pressure does not reach 3200 psi turn the Pressure Limit screw clockwise to increase the pressure to 3200 psi.

e) If the pressure exceeds 3200 psi turn the Pressure Limit screw counter clockwise to reduce the pressure to 3200 psi.

f) The differential pressure is set at the factory and does not require adjustment.

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8.7.2 Pump Volume Stop Adjustment

IMPORTANT **This procedure should be performed only after a new hydraulic pump has been installed. Changing the adjustments on a tuned pump may cause adverse effects in the system.**

The pump volume stop limits the flow of the hydraulic pump flow to the amount necessary to support the maximum orifice size. This set-up protects against the motor drawing excessive current.

a) Install a .018" orifice in the cutting head.

b) Start the motor and intensifier, and set the water pressure to 60 KPSI or 3100 psi hydraulic.

c) Turn the cutting head on. The pump is now operating at its highest power level.

d) Loosen the lock nut and turn the volume stop clockwise until the pressure just starts to drop.

e) Turn the control one quarter turn in the counter clockwise direction.

f) The control is now set. Retighten the lock nut on the volume stop control.

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Section 9

Specifications

The following specifications describe the requirements and capabilities of the AS-6050 pump.

9.1 Pump Requirements

Pump Power: 50 Horsepower 60 hz

- Voltage 460 VAC +/-10%
- Current 67.5 A
- Main C.B. Rating 90A

Physical:

- Size 78”Wide x 40”Deep x 57”High
- Clear Height 84”
- Shipping Weight (in crate no oil) Approx 3400#
- Operating Weight Approx 3200#

Ambient Conditions:

- Min Storage Temperature (not drained) 34ºF
- Min Operating Temperature 50ºF
- Max Operating Temperature 110 ºF
- Max Relative Humidity 95% @ 100 ºF or non-condensing

Inlet Cutting Water

- Min Inlet Water Pressure 20 psi
- Max Inlet Water Pressure 115 psi (See LP Water Section)
- Max Inlet Temperature 70ºF
- Min Inlet Temperature 40ºF
- Minimum Inlet Flow Rate 2 GPM
- Inlet Water Quality See Following Water Quality Section

Hydraulic Cooling Water

- Min Inlet Water Pressure 40 psi
- Max Inlet Water Pressure 115 psi (See LP Water Section)
- Max Inlet Temperature 70ºF
- Min Inlet Temperature 40ºF
- Normal Inlet Flow Rate 3 GPM

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Hydraulics

• Hydraulic Oil Type	ISO VG 32 mineral oil
• Hydraulic Oil Capacity	40 Gallons
• Max Oil Temp	130 ºF
• Min Oil Temp	55 ºF

Pump Factory Settings

• Hydraulic Pump Pressure Limit	3200 psi
• Cut Pressure Set Point*	45,000 psi
• Pierce Pressure Set Point*	20,000 psi

* Adjustable after start-up

Utility Hook-Ups located at rear of pump

• Cooling Water In	¾" NPT Female
• Cooling Water Out	¾" NPT Female
• Cutting Water In	¾" NPT Female
• Drain Water Out	¾" NPT Female
• Cutting Water Out	3/8" HP Female

Warnings and Shutdowns

• Intensifier Over Cycle	Shutdown
• Inlet Cutting Water Below 30 psi	Shutdown
• Hydraulic Oil Level Low	Shutdown
• Hydraulic Oil Temperature Over 130ºF	Warning
• Hydraulic Oil Temperature Over 150ºF	Shutdown
• Oil filter Clogged	Warning
• Motor Fault	Shutdown

9.2 Pump Capabilities

Max Continuous Output Pressure	60,000 psi
Min Output Pressure	5,000 psi
Max Output Flow	1.1 gpm

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9.3 Orifice Combinations

This pump will support at least the following combinations:

- Qty 1 .016 orifice
- Qty 2 .011 orifice
- Qty 3 .009 orifice
- Qty 4 .008 orifice
- Qty 5 .007 orifice
- Qty 6 .006 orifice

9.4 Inlet Cutting Water Requirements

The inlet water should be clear, odorless, free of biological materials and have a pH of 6 to 8.

The water quality analysis should measure for:

- pH
- Silica Content
- Total Dissolved Solids(TDS)

Most systems only need water softening to pre-treat the inlet cutting water. Poor water quality may require that the water be treated to remove the high levels of TDS. One approach is to have the local water conditioning company provide deionizing tanks(DI) on an exchange basis. Another approach for poor water is to install a reverse osmosis system (RO). The RO approach is best for high gallon per day users.

Water Treatment Guidelines:

Do not treat to 0.5 ppm or less. Water of this high of purity is overly aggressive and will damage stainless steel components.

• High Quality Water	TDS<50 ppm	no treatment required
• Good Quality Water	50ppm<TDS<150ppm	Soften only
• Medium Quality Water	150ppm<TDS<250ppm	Soften or TDS removal
• Poor Quality Water	TDS>250ppm Silica>15ppm	TDS removal

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9.5 Bolt Torque

This specification applies to all fasteners that are used to make hydraulic connections and high pressure connections such as: hydraulic flange fittings, proximity switch to end cap, hydraulic manifold to end cap, 1" intensifier nuts, and intensifier center section cap screws. Torque values are for lubricated grade 8 fasteners.

Specific Torques:

- 1" Nut on Intensifier Stud 275 foot-lbs
- 7/8 Cap Screw on Intensifier Center 275 foot-lbs

General Torques

Cap Screw or Bolt Size	Torque
#10	45 in-lb
1/4	105 in-lb
5/16	18 ft-lb
3/8	33 ft-lb
7/16	53 ft-lb
1/2	80 ft-lb

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Section 10

Maintenance & Troubleshooting

10.1 Maintenance

This section outlines the scheduled and preventative maintenance required to keep the intensifier pump in good working order. The following pages contain Parts and Service contact Information, Maintenance Guidelines, a Scheduled Maintenance Chart, and a Maintenance log.

10.1.1 Parts and Service Contact Information

Accustream Inc.
4757 Mustang Circle
Mounds View, MN 55112

Toll Free: 1-866-566-7099
Phone: 763-717-7099
Fax: 763-717-7093
Email: Info@Accustream.com
Web: www.accustream.com

10.1.2 Maintenance Guidelines

The AS-Series pumps require preventative and scheduled maintenance to remain in good working order, prevent unscheduled downtime, and extend the life of the components. To provide safe and proper maintenance, read and follow all Maintenance Guidelines in this section.

⚠ CAUTION **Always bleed down all HP water pressure and lockout the electrical control cabinet prior to performing any maintenance. Failure to do so can result in severe injury**.

⚠ CAUTION **High pressure water leaks can cause major damage to anything in its line of fire. Always repair any leaks immediately to avoid damage to equipment and/or serious personal injury.**

- Carefully read all of the safety guidelines in the Safety section of this manual. Read and understand the pertinent sections to the maintenance that you are planning to perform.

- Shut off the main disconnect. When the power is shut off, the bleed down valve will open and bleed off high pressure water stored in the discharge piping. Always double check to make sure that all high pressure water has been discharged prior to servicing the pump.

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- When servicing any electrical component of the pump always follow proper lockout/tag out procedures. Remember even when the main disconnect is off the lines coming to the pump are still hot unless shut off at their source.

- When servicing the cooling or cutting water assemblies, shutoff water to the pump and drain the water in the accumulator by opening the ball valve to the left of the filters.

- Use catch pans under areas where water or oil may be spill during the course of maintenance.

- Always maintain a clean work area. Inspect and clean the pump regularly to spot issues before they become costly repairs. Always make repairs immediately. Keep a maintenance record.

10.1.3 Scheduled Maintenance Chart

The following maintenance intervals are based on 4000 hour per year operation. Less hours of use will increase maintenance intervals.

	Maintenance Description	As Required	Per Shift	Weekly	Monthly	3 Months	6 Months	Yearly
Electrical System	Inspect all Cables and Plugs for Damage		I					
	Check Safety Circuits			I				
	Grease Motor Bearings							I
Low Pressure Water	Inspect Fittings and Hose for Damage		I					
	Adjust Cooling Water Flow	A						
	Check Inlet Water Pressure		I					
	Inlet Water Filters		I			R		
	Check Pressure in Water Accumulator - Set to 40 psi						I	
High Pressure Water	Visually Inspect for Leaks		I					
	Check Temperature of Intensifier and Bleed Down Valve		I			R		
	Lap LP Poppet and Check Valve Face							
	Replace HP Seals	R						
	Replace HP Filter at Pump Outlet				I		R	
	Replace Hydraulic Rod Seal	I						R
	Replace Plunger Bearing	I						R
Hydraulics	Change Oil Filter (Sooner if By-pass Occurs)						R	
	Change Oil			I				
	Check Oil Level			I				
	Check Oil Temperature			I				
	Check for Oil Leaks			I				

A - Adjust I - Inspect R - Replace

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10.1.4 Maintenance Log

Pump Model _____ Serial # _____

		Problem Found and Work Performed
	Date	
	Hours	
	Initial	
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Maintenance Log

Pump Model _____ Serial # _____

		Problem Found and Work Performed
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Maintenance Log

Pump Model _____ Serial # _____

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Maintenance Log

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10.2 Troubleshooting

The following troubleshooting chart lists symptoms, possible causes, and recommended solutions for troubleshooting the AS-Series pumps. If you receive a fault message and have corrected the fault condition you can reset the pump by pressing the ACK/RESET button on the front control panel. This will clear the fault and allow you to re-start the pump.

1. Fault Display Error Message

Display Error Message	Possible Cause	Corrective Action
Hydraulic Oil Level Low	The Oil Level had dropped from a leak at a fitting or from performing maintenance on the hydraulic assembly.	Inspect the fittings and components of the hydraulic system for leaks. After Identifying the cause of lost oil, add oil per instructions in the Hydraulic section of this manual.
	Cable may be damaged or connector is unplugged.	Replace cable if damaged. Plug in connector if unplugged.
Hydraulic Oil Temp > 130F (55C) or Hydraulic Oil Temp > 150F (65C)	Inlet cooling water to the pump not turned on.	Turn on inlet cooling water. Read the Low Pressure Water section of this manual.
	High cooling water inlet temperature.	Test the temperature of the inlet water. If the temperature is outside of the normal range outlined in the Specifications section of this manual you may need a water chiller.
	Cooling water flow rate may not be high enough.	Check the flow rate by monitoring the cooling water out. If the flow rate is too low then adjust the water modulating valve. See the Low Pressure Water section of this manual.
	Cable may be damaged or connector is unplugged.	Replace cable if damaged. Plug in connector if unplugged.
	Heat exchanger could be clogged.	Repair or replace heat exchanger.
Motor Fault	Fuse FU-5 in the PLC has blown. A short in the cooling or cutting water coils is the most likely cause. A less likely scenario would be a short in the motor wiring for the boost motor or main motor.	Check the cutting water coil (SOL-1) and the cooling water coil (SOL-2) for shorts. Usually you will see the plastic body deformed from heat. Check all cables for damage. Replace any faulty parts.
	The main motor thermal overload (OL-MAIN) may have tripped.	Reset by pushing the reset button on the thermal overload. Refer to Electric Motors in the Electrical System section of this manual.

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Display Error Message	Possible Cause	Corrective Action
Inlet Water Pressure Below 40PSI (2.8BAR)	Inlet cutting water to the pump not turned on.	Turn on inlet cutting water. Read the Low Pressure Water section of this manual.
	Boost pump motor contactor (MS-BOOST) may be tripped. If this is the cause you will see the knob pointing at reset.	Reset by turning the knob on the motor contactor back to auto. Refer to Electric Motors in the Electrical System section of this manual.
	Boost pump thermal overload (OL-BOOST) may be tripped.	Reset by pushing the reset button on the thermal overload. Refer to Electric Motors in the Electrical System section of this manual.
	Boost pump fuses FU-9, FU-10, or FU-11 may be blown.	A blown fuse is evidence of a potentially serious problem such as a severely damaged motor, or a short in the system. Locate and correct problem, replace fuse, and restart the pump.
	The cutting water coil (SOL-1) may be shorted.	Inspect the coil. Normally a short in the SOL-1 coil or its cable would result in a blown fuse FU-5 and a fault message of Motor Fault so this is an unlikely scenario. If the coil or wire is damaged, replace it and restart the pump.
Too Many Motor Starts Per Hour	The motor has been started too many times in 15 minutes.	Wait 15 minutes to let the motor armature cool down before starting again.
Intensifier Over Cycle (pay attention to arrow direction)	Several possibilities exist for the possible causes of this error. The error caused by the intensifier stroking too quickly in one or both directions.	Note the direction of the intensifier over cycle and refer to Intensifier Cycle in the High Pressure Water section of this manual.

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2. General Pump Operation

Problem	Possible Cause	Corrective Action
Pump Will Not Start	Power disconnected	Reconnect power Check Main Disconnect
	E-Stop depressed	Pull out all E-stop buttons
	Pump enclosure door open	Close door and properly latch disconnect handle
	Motor overload relay tripped	Check and correct Adjust volume stop on pump
	Line Fuses Blown or Missing	Check and correct
	Pump Remote key switch in wrong position	Change key switch position
Hydraulic Pump Does Not Make Pressure or Makes Low Pressure	Defective Cut Pressure Select solenoid	Manually over-ride valve until replacement arrives
	Defective Cut Pressure Control valve	Replace valve
	Defective hydraulic pump and/or compensator	Replace pump
	Defective relief valve	Replace valve
	Pierce pressure is enabled	Change pierce pressure to cut pressure at the display

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3. Intensifier Operation

Problem	Possible Cause	Corrective Action
Intensifier Does Not Cycle	On/Off Valve for cutting head is off	Turn cutting head on
	Intensifier is disabled	Enable intensifier at display
	Defective shift valve or end of travel proximity switch	Replace if necessary
	One of the indicator pins is hung up as shown by both proximity switch lights on at the same time	-Disassemble and repair. Pins must move freely to bottom of bore
Intensifier Cycles and Oil Pressure Okay But Not Enough Pressure at Head	Clogged high pressure filter	Replace HP Element
	Partial obstruction in HP lines	Correct obstruction
	Worn Hydraulic Piston Seal	Rebuild hydraulic center section
	Too much demand on pump	Reduce number or size of orifices
Intensifier Over Cycles or Cycles Unevenly	Various reasons	See Over Cycle Section in HP Water

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4. High Pressure Cylinder and Check Tube

Problem	Possible Cause	Corrective Action
End of HP Cylinder Drips	Worn HP Seal	Replace HP Seals and Hoops
Cylinder End Drips And Is Hot	Check for crack at end of HP Cylinder	Replace HP Seals and Hoops and HP Cylinder if necessary
Check Valve Is Hot and HP Cylinder End Drips	Check for crack in Check Valve Body	Replace HP Seals and Hoops and Check Valve Body if necessary
Check Valve is Hot and HP Cylinder End Does not Drip	Leaking HP Poppet and Seat	Replace
	Leaking LP Poppet and Check Valve Body face	Replace or repair
Oil Present In Dynamic End of HP Cylinder	Leaky hydraulic rod seal	Replace rod seal
Bronze Back-Ups Have Short Life	Worn Plunger Bearing	Replace Plunger Bearing
Hydraulic Center Section Is Much Hotter Than Hydraulic Oil	Piston seal is worn	Rebuild center section
	Piston seal has just been replaced and needs breaking in	No action required
HP Seal Life Is Short	Poor mating surfaces	Inspect, repair and/or replace HP Cylinder ID and Plunger
	Pump has cycled roughly	Start-up new seals carefully
	Pump over cycled	Check demand on pump
	Worn bronze back-up	Replace Back-up
	Cylinder end too hot	Correct problem. Refer to the High Pressure Section of the manual
	Hoops are broken from belled out HP cylinder end	Replace HP cylinder when necessary

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5. Hydraulic Oil

Problem	Possible Cause	Corrective Action
Oil Is Too Hot	Worn relief valve	Replace
	Inlet water is warmer	Adjust modulating valve
	Piston seal in intensifier is worn	Rebuild intensifier center section
	Heat exchanger is fouled	Clean out heat exchanger tubes or replace heat exchanger
	Hydraulic pump is worn	Replace
Oil has milky appearance	Oil is contaminated with water	Replace oil per the manual instructions. Replace rod seal .
Oil Life is short	Oil temperature too hot	Reduce oil temperature

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Section 11

Drawings and Parts Lists

The following Parts Lists and Drawings are in numerical order with the exception of the main assembly which is the first shown.

Part Number	Description
12086	AS-6050 ASSEMBLY
11480	BLEED DOWN VALVE ASSEMBLY
11501	INTENSIFIER ASSEMBLY
11534	LOW PRESSURE WATER ASSEMBLY
11537	HIGH PRESSURE WATER ASSEMBLY
11563	HYDRAULIC TANK ASSEMBLY
11585	ELECTRICAL FRAME ASSEMBLY
11805	CONTROL MANIFOLD ASSEMBLY
12042	AS-6075 HYDRAULIC HOSE AND FITTING LIST
12048	AS-6075 ELECTRICAL SCHEMATIC
12049	AS-6075 ELECTRICAL ENCLOSURE ASSEMBLY
12050	AS-6050 MOTOR PUMP ASSEMBLY
12084	BASIC TOOLS KIT
12085	RECOMMENDED TOOLS KIT
12087	INTENSIFIER BASIC SPARES KIT
12088	INTENSIFIER FULL SPARES KIT
12113	AS-6050 HYDRAULIC ASSEMBLY

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